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Roller Bearings for Air Service

J. B. Nealy
American Gas Association

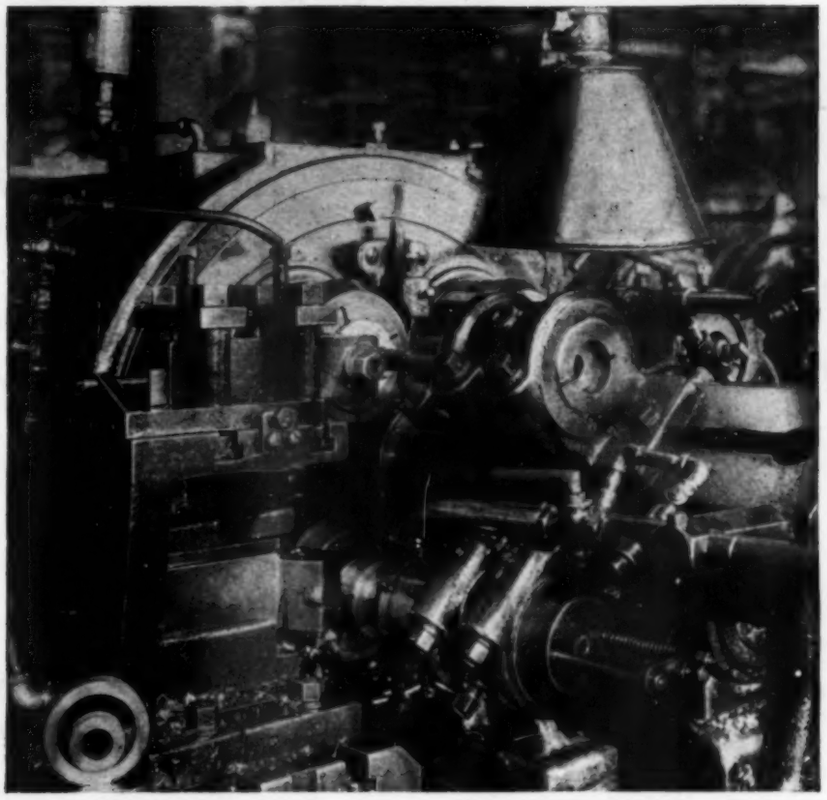


Fig. 1—The trepanning tool shown in the lower position forms the inner and outer races from one solid bar

AT THE Hartford plant of the S.K.F. Industries, a roller bearing has been developed especially for aircraft engines. This bearing will sustain a greater load than a ball bearing of the same size. Because of its light weight per unit of carrying capacity and its unusually low coefficient of friction, as compared with other types of roller bearings, it is particularly suited to air usage. The cages are made of Duralumin for lightness and strength. The steel for the races and rollers is made in Sweden from ore mined by one of the subsidiaries of the S.K.F. Industries. The steel is tested both chemically and physically. It has a chromium content of from 1.40 to 1.65 per cent, and its maximum content of phosphorus and sulphur is 0.025 and 0.02 per cent, respectively.

Races for the largest size of bearings are forged, but those for the smaller sizes are machined from solid bars in a multi-spindle automatic screw machine, as shown in Fig. 1. Operations performed by this machine are: turn to diameter; bore out center; trepan the material between inner and outer races; cut off and face the inner race. The cutting tools are arranged in four groups, and the bars make a quarter turn after each series of operations has been performed. This machine will turn out 1,200 races of one size in a day. Cutting the grooves in the outer races and chamfering all four edges are done in a subsequent lathe operation.

After machining, the races are carefully heat-treated in a department equipped with modern appliances (Fig. 2). In one section are five box-type gas furnaces of steel incased brick, provided with eight burners each. The furnaces are under-fired and semi-muffled, and are used for heat-treating the forged races. Two large tanks provided with running water are used for quenching.

The heat-treatment of the races made from the bar is done in three long furnaces that are continuous and automatic in their operation. The burners are located along the sides and direct the flames beneath the work. One furnace is provided with a shaker hearth, a type but little known in this country. This unit is 10 ft. long, 3 ft. wide, and 2 ft. high, and has nine burners. The

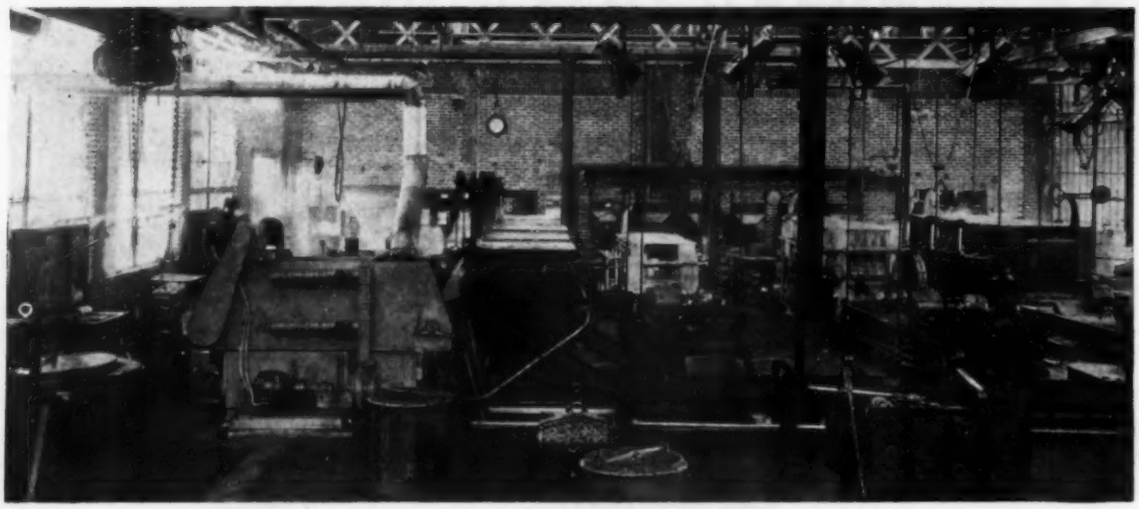


Fig. 2—Automatic material handling and fire prevention are used in the heat-treating department

alloy-steel hearth is 15 in. wide and has flanges on each side to prevent the work from falling off. It extends 4 ft. beyond the charging end of the furnace to serve as a loading table. The hearth is operated by a motor through a cam and a link, giving it a reciprocating motion, slow in the forward stroke and fast on the return. This motion causes the work to progress along the hearth at a rate regulated to suit the work being heat-treated.

At the discharge end of the furnace, a steel chute under a slot in the hearth is provided to carry the work into the quenching tank. The tank is provided with an elevator conveyor, which receives the work, carries it through the quenching medium, elevates it, and drops it into trays for further handling. The oil used for quenching is kept in circulation by a motor-driven impeller. The correct temperature gradient is maintained in the furnace by an automatic temperature control consisting of solenoid valves on the feed lines for gas and air, together with thermocouples within the furnace. There are two other furnaces, similar in construction but somewhat larger. They have twelve burners and automatic temperature control as described. All are provided with recording pyrometers.

The conveyor hearths of these two units are unique. They consist of a series of alloy-steel rods set close together and extending across the furnace to form a continuous bridge through its length. These rods project through the side walls of the furnaces and are provided with small sprockets, driven by a chain on the outside. The rotary motion given the rods by the chain causes the work to progress. The chain is motor-operated through a speed-reduction gear, by means of which the furnace heating-cycle can be regulated.

These units are served by quenching tanks provided with motor-driven elevators, and each one is equipped for oil circulation. Another unique feature is the automatic fire-prevention system provided for the quenching tanks. It consists of a series of fan-shaped nozzles distributed about the edges, and so placed that they will direct streams of chemicals to the surface of the oil. Above the tanks are fire extinguishers connected to the nozzles by pipes with control units of a low-melting alloy. In case of fire, the heat melts these units, the chemicals are automatically released, and are sprayed over the surface of the oil.

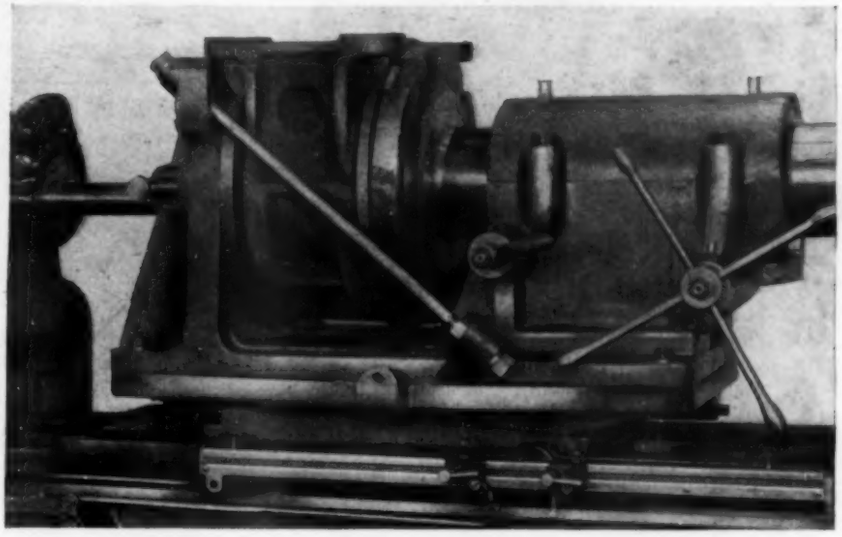
These three furnaces are placed side by side, so that the discharge ends of the quenching tanks are in line. The tray system of handling has been supplanted by a continuously traveling conveyor to which each of the elevator conveyors discharges directly. This last conveyor takes the work to and through an automatic washing machine, and then discharges it into trays for further handling. An overhead traveling crane is used for handling the heavier work. The temperature of the quenching oil is automatically held at about 110 deg. F. by water circulated through pipe coils within the tanks. Whenever the temperature drops below the point set, a valve automatically shuts off the water, but allows it to flow again when the desired temperature is reached.

The steel parts are heated to from 1,480 to 1,560 deg. F., according to size and the physical characteristics required, a 10-deg. variation being allowed after the exact determination has been made. The parts are usually drawn to a temperature of 350 deg. F., which ordinarily gives them a Brinell test of 655. The treatment given the Duralumin cages consists of heating them to from 950 to 960 deg. F., quenching in water or oil at a temperature of from 100 to 212 deg. F., and aging them for 48 hours at a temperature of 70 deg. F. This treatment gives the cages a tensile strength of 62,000 lb. per sq.in., a yield point of from 30,000 to 36,000 lb. per sq.in., and elongation between 18 and 25 per cent in 2 in. A Brinell hardness of from 93 to 100 results.

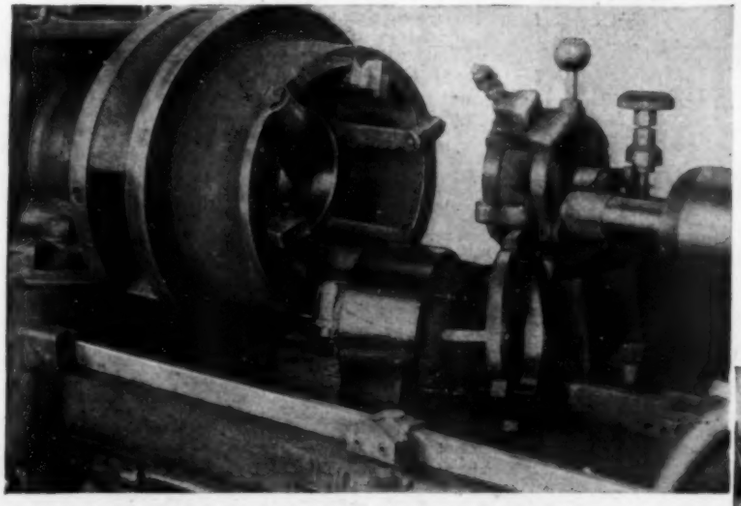
GRAPHITE greases should not be used for anti-friction bearings, whether ball or roller. The graphite flakes build up and clog up between the roller and the races and may result in entirely stopping the rolling action. For high-speed bearings, oil must be used. It is good practice to have a felt strainer, also to let the oil run out after being used so that it may carry off any chips or particles from the bearings. The oil should be selected for proper weight or thickness, for lubricity, and for purity and freedom from sulphur or acid.

Methods of Grinding Motor Stator Frames

WITH the improvement in grinding methods and equipment during the past few years, certain of the motor manufacturers are now grinding stator bores in order to attain a uniform air gap between stator and rotor. Various times are chosen for grinding, depending upon conditions in the particular plant and opinions of individual engineers. Thus, in some cases, stator laminations are ground previous to their being pressed into the motor frame, in others after being pressed in but before the winding is assembled, and in still others after the windings are placed.

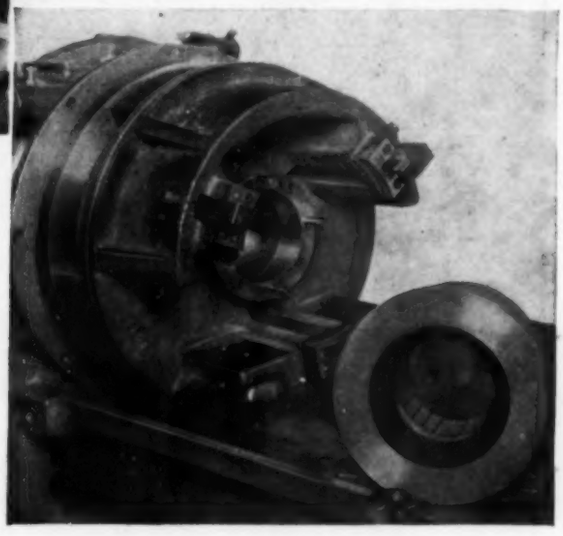


Larger lamination assemblies are usually handled in motor frames without windings and centralized from rabbets at each end of the frame. Independently operated endwise clamping plates are required to prevent teeth from turning while grinding. Centralizing members locate readily regardless of the side spreading of the lamination teeth previous to clamping



Small stator lamination assemblies in motor frames with windings are centralized from rabbets at each end of the frame. No endwise clamping of the laminations is necessary, since the windings hold the stator teeth solid

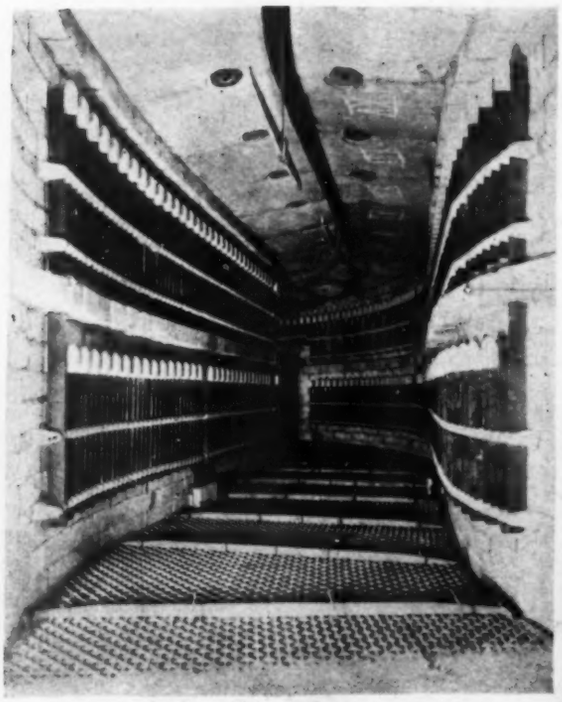
Photographs courtesy of the Heald Machine Company



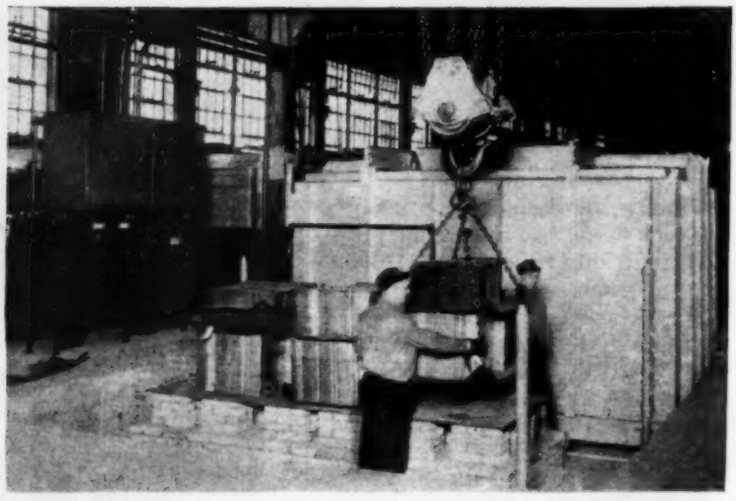
Small lamination assemblies, with or without motor frames but without windings, are preferably centralized from the roots of lamination slots, laminations being clamped firmly endwise at the tips of the teeth to prevent their turning or bending during grinding. It is important that the punched bore be sufficiently concentric with the root of the winding slots so that bores will clean without the necessity of removing an excessive amount of stock

If We Anneal Electrically—

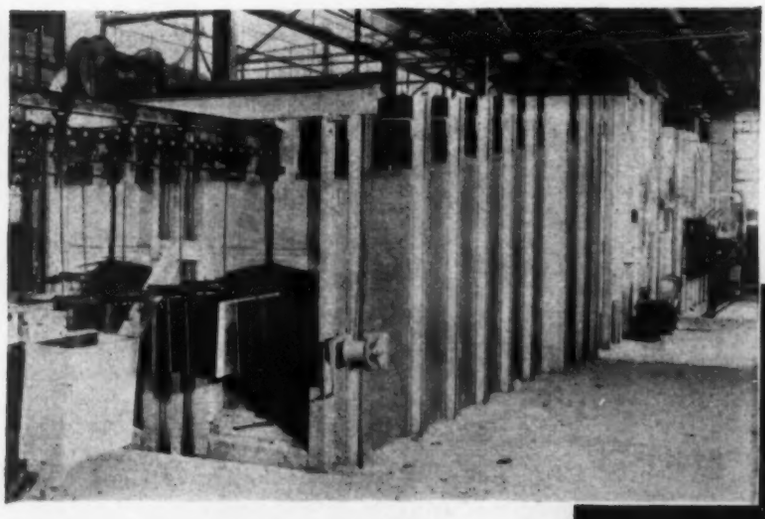
Steel, Aluminum, Brass, Copper



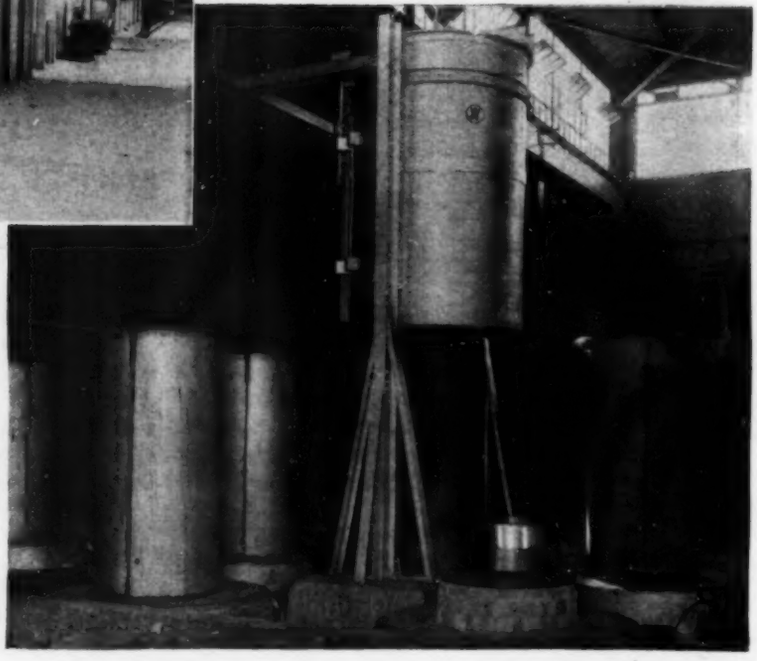
Above—The first zone in the heating chamber of a "horseshoe" type continuous vitreous enamelling furnace. Conveyor work rods depend through the roof, and heavy, substantial heating elements are located on the sides and bottom



Above—Large rectangular "bell type" furnace used for annealing motor and generator punchings of high-silicon steel. Sizes up to 60,000 lb. per charge are in use. Their output is flexible in that several bases may be used with the same bell, extra bases being cut in or out to suit production requirements



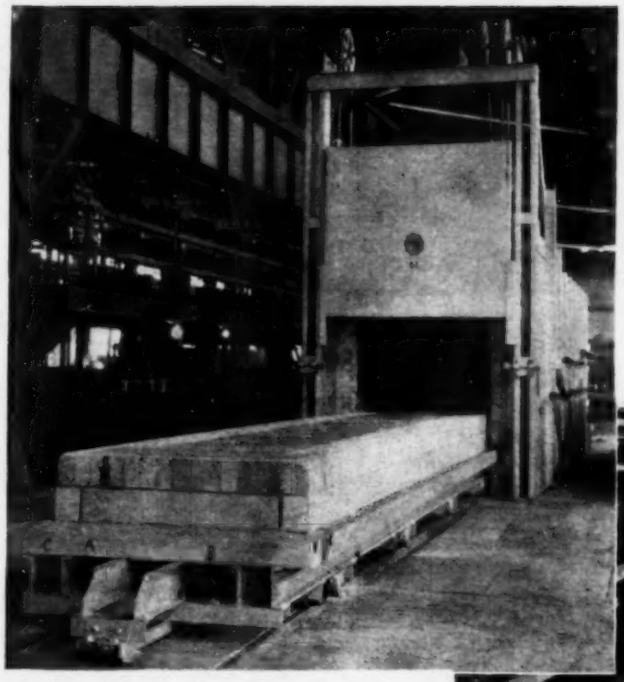
Above—Overhead conveyor, continuous type vitreous enamelling furnace. This, or a modified design, may prove adaptable for sheet annealing



Right—Westinghouse circular "bell type" furnace for bright annealing cold-rolled steel strip. The bell is shown in raised position. Six bases are on wheels on a track, and can be pulled from one place to another to permit loading. The gas-tight hoods cover the charge before the bell is lowered over the base. Artificial atmospheres are used

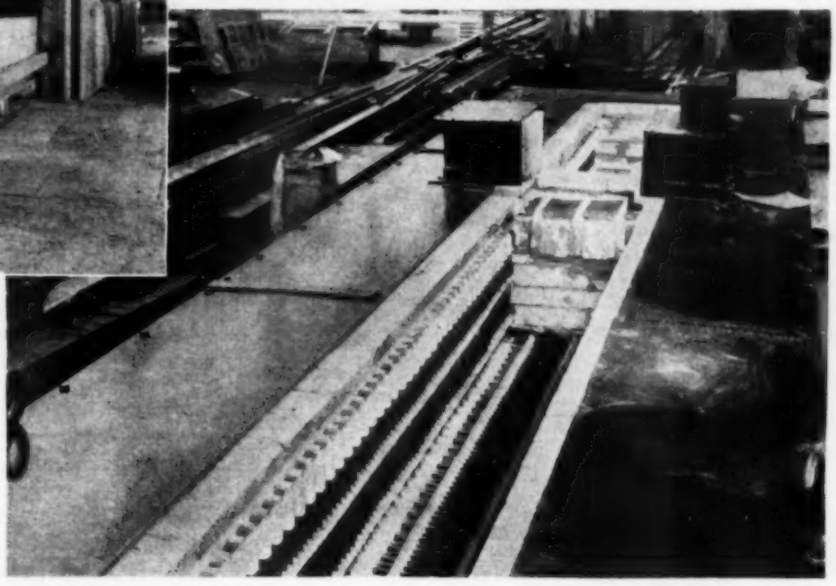
Development of correct heat-treatment for metals and alloys has aided materially in recent engineering advances. Automotive manufacture, principally, has necessitated maintenance of rigid specifications as to hardness, strength, grain size and structure, surface finish, and condition. Electrically heated furnaces have proved of advantage in this class of work because of the ease of temperature regulation and ability to maintain proper atmosphere. Most ovens for this work are built for a particular job

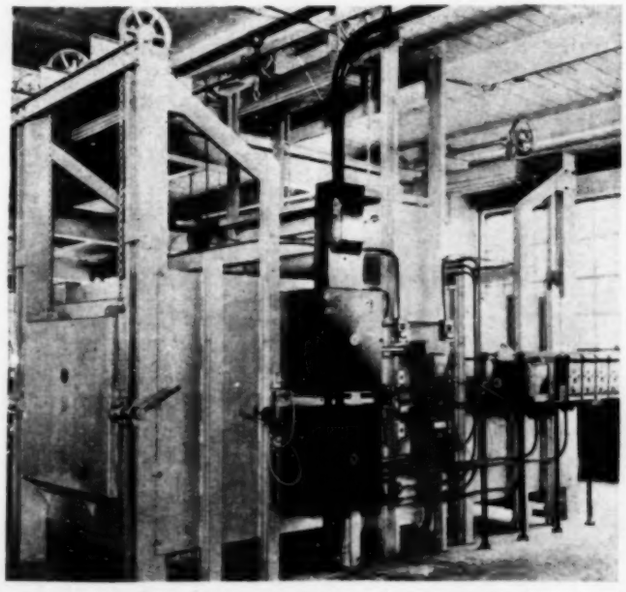
Photographs from the Westinghouse Elec. & Mfg. Co.



Above—Large car-type electric furnace with motor-operated door and car, used for steel sheet, shape, or casting annealing. Artificial atmosphere work has so far been unnecessary

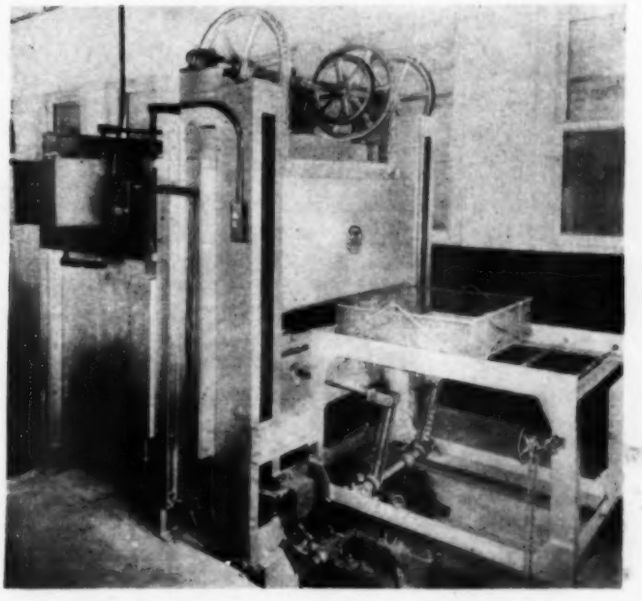
Right—Double lead bath furnace. Vessels have been removed to show the heating chambers. The first chamber is for hardening, the second for quenching and drawing steel wire





Right—Supplanting yesterday's wood fires for annealing short brass tubes are these "walking beam" type conveyor furnaces. Temperature variations are usually rather wide, but proper annealing eliminates picking, scaling, bad work, and similar faults. For copper annealing, a steam atmosphere with water seals is often used

Left—Annealing aluminum alloy airplane parts is done at close temperature variations, in box, pit, conveyor, car-bottom, and bell type furnaces. This is a special furnace having a motor-operated center door which, when lowered, divides the chamber into two parts that can be operated at different temperatures



EXECUTIVE FORUM

Who Buys?

POOR MATERIAL is the pet aversion of most works managers. It had much to do with Bert Jennings' loss of composure as he stood by the horizontal boring mill in the shop of the Express Machine Company and emphatically expounded his views to Ralph Cary, the Chief Engineer.

"Just look at these steel castings," said Jennings. "They have a crust of fused sand, and from the way they cut, you'd think they were shot with diamonds. The speed is down to 15 feet now, and still the tool rides over the hard spots. I can't expect a man to bore a straight hole through material like that. And this is a rush job too."

Cary said, "Too bad. I wish I could soften them up for you, but that's out of my line. I'm afraid I can't be of much help."

"But you can," said Jennings. "Not on these castings, but with our future purchases. There's Bradford now. Let's get him over here."

The purchasing agent happened to be passing down an adjacent aisle at this inopportune moment, and Jennings hailed him. He listened to the works manager repeat his difficulties with the castings in particular and with purchasing methods in general.

"Why can't we get castings like those we had last week?" Jennings asked. "They were good."

"As a matter of fact, these are from the same foundry," said Bradford. "We asked for a rush shipment, and the annealing may have been hurried. But this is the first complaint you've had on steel castings in a year. We can't always expect perfect material."

"Sometimes we suffer in silence," said Jennings. "But let's get to the source of the trouble. This is the first plant I ever worked in where the purchasing agent reported to the chief engineer. I can see no logic to a set-up like that. Out here in the shop, we use practically all the material purchased. So the shop should control buying."

"I don't agree," said Cary. "The engineering department determines what should go into our product and is largely responsible for its performance. It must draw up specifications which is really the first step in buying. So the control belongs right where it is now."

"You also specify sizes and fits. But you don't do the machining. You make out a bill of materials and then forget about it. But here we have the job of carving out machines. Don't you think that you could work more efficiently under the shop, Bradford?"

Bradford shook his head emphatically. "No, buying is in no sense a function of production."

"Just as I said," said Cary. "The engineering department is the logical place."

Again Bradford shook his head. "No, purchasing is just as important in its way as either designing or production. Correct buying can save the company money and thus make a real contribution toward profits. It can no longer be left to a clerk who merely sends out inquiries and accepts the lowest bid. There are too many angles to be considered. We must weigh vendors' responsbiility, continuation of supply, service, and many other factors. Buying is becoming more and more a business of mutual confidence. It is recognized that a fair profit to the vendor is to the best interests of the purchaser. Buying is a science in itself and deserves the dignity of a separate department reporting directly to the president."

"Would that get us any better steel castings?" asked Jennings.

■

What Do You Think About This Problem?

During the "buyers' market," which has existed in the past year or so, purchasing has been regarded as an almost automatic function. Low prices have been obtained by pitting one supplier against another. But a new conception of buying has already come into evidence. It is realized that fostering cut-throat methods benefits no one in the long run. What department in an industrial plant is best qualified to handle this important activity?

. . . Discussion
of Executive Problems

Come Seven?

No arbitrary length can be set for a standard day or week, since only the basic law of supply and demand can govern. Following this law, it seems obvious that in any country, community, or industry, when commodity demand slacks off, the proper reaction is to reduce the hours worked per employee. This would insure a steady, even though curtailed, buying capacity to each individual rather than to create a no-income group, which in one way or another must inevitably constitute a burden on business and those who are employed. It follows that to maintain costs the total hours worked by all must conform to the economic figure which works out to the best overhead, and that all efforts on the part of organized groups to maintain total wages irrespective of hours worked must be ignored as basically unsound. Sooner or later, a program will be developed to give individuals regular income-producing jobs.

While more leisure results from curtailment in working hours, this element can only be considered as an accessory to the main proposition. That is the insuring of an earned income to every supporting individual, unless that individual is among those fortunate ones, capable of deriving support from capital or inheritance.

—D. C. WRIGHT.

On With the New?

I strongly favor promoting those on the spot wherever a suitable candidate is present. To engage a stranger dashes hopes and kills ambition in loyal ones. What is more demoralizing, after serving years in the hope of advancement, than to see a stranger engaged for a good appointment? It is not fair, and causes unrest, heartburning, and laxity.

Promotion is also advantageous to the firm. The craze for new blood is amusing, inasmuch as the blood already in the shop has no chance to show its quality. There are always able, ambitious men who, given a chance, would prove better than the majority of strangers. They know the work and the men, and possess ideas and initiative equal to anyone else. It is a mistake to assume they will follow the steps of the previous man, thus keeping in a rut. Being intelligent, they know his weaknesses, steer clear of them, and manifest originality. Above all, a life's experience and observation proves this policy to be successful, which after all is the vital argument. The most successful firms I have known have practiced it.

—WILLIAM BRYCE,
Sheffield, England.

Dole or Control?

There is no lack of raw materials nor of facilities for handling and manufacturing them expeditiously and cheaply, and no lack of people requiring the finished products. Yet the prolific producer and the hungry consumer are unable to act their complementary parts. Such a situation is certainly avoidable. When mankind has given as much thought to this problem as it has already given the fashioning of tools, the violence of such periods of depression will have passed.

Meanwhile—what? The remedy depends on the conception of the function of industry. Primarily industry exists to supply the needs of mankind. Mankind lives in communities. In most of these communities, one of the cardinal principles is that the care of the individual is in the community's hands.

Each industry must stand on its own feet if we are to retain a true perspective of its functions and must only retain on its books the necessary workers for its product. Its energies should be directed toward perfecting its product and producing it efficiently. The problem of the worker thus displaced is essentially one for the state to handle. It is too large and serious a problem for small units to control, and indeed in the course of time, may become an interstate affair. The issue can be more thoroughly understood and wisely handled when done on a national basis. The cost of unemployment is of course shared by firms in the form of taxes and other national levies and by them passed on to their customers.—G. HYLOTT, *Glasgow, Scotland.*

Leveling the Load

Few industries enjoy an even demand for their products. The type of plant that is most suitable to leveling the load is that producing a standardized article in large quantities. A plant building to customer's specifications is hardly able to govern its production by anything except the specific demand of its customers. Articles that can be stored easily without deterioration or obsolescence form the best examples of goods that can be made in quantity. Bulky articles or those that deteriorate rapidly are not readily manufactured for storage. There is a possibility of an even production schedule for products of large bulk when the component parts are made and stored, to be assembled as demand indicates. Oftentimes, the introduction of a side line, which has demand characteristics the opposite of the article already produced, will help. Sometimes price concessions in slack times will increase the demand, but caution must be exercised so the practice does not become suicidal. The importance of accurate sales forecasts should not be under-emphasized. Without them, any load leveling effort is practically useless.

—M. F. SAXTON,
Allis-Chalmers Manufacturing Company.

Ex Rights

Of six installations for production control and cost accounting systems, which I have developed, the company for whom I saved over $300,000 a year is the only one that will not send me forms and other data. Practically all of this work was on my own time evenings, Saturday afternoons, and Sundays. Foreseeing their policy of refusing to recommend former employees, I kept

monthly cost figures and copies of reports showing the results accomplished during my administration. In dealing with a company of that sort, ethics are as foreign and unknown to them as the airplane was to Columbus. I have asked for and obtained data, not once but several times, from each of the other five companies, and each time it was accompanied by a friendly letter. Some executives consider that in employing a man they buy his body, soul, and mind for twenty-four hours a day 365 days a year. Fortunately this class of executive is being eliminated by its own actions and unpopularity.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Company.*

Promising Performance

One good reason for a builder of machinery to guarantee his product is that to have it in a plant where it is not giving entire satisfaction may prove to be a very poor advertisement. By removing unsatisfactory equipment, the object of derogatory discussion is soon forgotten and embarrassment to the officials making the purchase is removed; these officials will have a better feeling toward the firm that is willing to admit defeat even under conditions over which it has no control. With this feeling of good will prevailing, the vendor would have a chance to have this equipment tried out on future work.

In selecting equipment that is guaranteed, the engineer bases his choice upon the makes which in his judgment will give the longest service with the lowest upkeep, assuming of course, that output is equal. Another reason for guaranteeing results, is to create confidence in the purchaser, and to convince him that the builder knows his article and what it will produce.

—C. F. STAPLES.

Sales Per Schedule

Sales cannot be treated at all similarly to production. The production man deals with work which is at hand and which he can see, but the salesman is largely in the dark as to the progress of his work. He has many more problems to deal with which are outside his control than the production man. Probably every purchaser he interviews has to be handled differently. I am all for depending on the salesman's initiative; if salesmen are not encouraged to push sales as much as possible, how can a business grow?

Firms have gained good customers through a salesman's dropping in to see new prospects when he has a little time to spare on his regular rounds. Many little known firms are able to give substantial orders; these same firms may miss a sales manager's eye. Where big firms receive the attention of hosts of salesmen, lesser known firms do not, with the result that competition is less severe.

—W. E. WARNER, *Herts, England.*

The greater initiative, ingenuity and resourcefulness required of the salesman as contrasted with the production man, has often been cited as the reason for the comparatively greater return afforded him by industry. While there is undoubtedly a perfectly proper foundation for this attitude, industry makes too much of a fetish of this superioritiy of the salesman, and as a consequence, he is left too much to his own devices. A reasonable amount of the control, as practiced in production, can be successfully applied to sales.

As a recipient of salesmen's calls, I am often struck by the variable timing of such calls—successive calls by the same man may be two weeks apart or six months, often accompanied by a vagueness on the part of the salesman that makes me wonder if he knows why he is visiting me at that time. Scheduling here would do a lot of good. I would have some idea when his visits are timed, and could make my own plans to prepare for the seeking of definite information when he comes.

In certain industries, particularly on first contacts, it is highly desirable to have a technical man accompany the salesman. Too often I have been thoroughly disgusted by the salesman who calls a new material or product to my attention, and when I ask him the natural technical questions that will determine its possible utility to me, I am confronted with evasions and lack of definite information. Perhaps a sensible solution of the problem would be to schedule only a percentage of a salesman's calls—say 75 per cent, definitely leaving him free to make other 25 per cent on his own initiative.

—LEWIS J. YAPP, *Design Draftsman, Naval Aircraft Factory.*

Home Work

How far an executive should allow his work to infringe on his hours at home depends on his ambitions and his mental outlook. If he regards work only as a means of obtaining the where-with-all of life to be earned during certain hours of the day and as something to be forgotten when he leaves at night, he will not go very far. But when work becomes absorbing and aspirations soar high, when every extra hour spent on homework brings nearer the achievement of some ambition or the fulfillment of some enterprise—is there anything that can compare with it? Does the mind become dull and interest in life flag? There comes rather, the satisfaction of achievement and when higher positions are open, it is men with such a mental outlook who get the job. Enthusiasm as well as ability help a man succeed.

—R. G. HEWITT, *Yorkshire, England.*

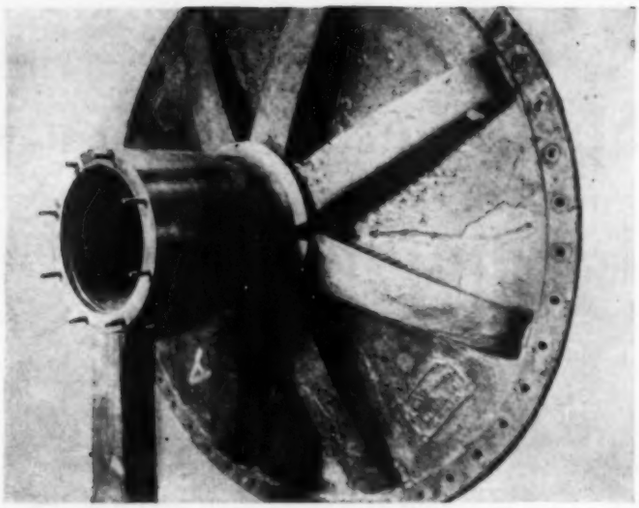
Everyone needs relaxation and change, but many lose sight of the recuperative value of interests apart from business. So easy is it to become over-absorbed in one's work, that it becomes increasingly difficult to switch over to the other and more rational lines of activity. It is an analagous course of action to the man who sets out to save a certain amount of money in the belief that after having attained his object, he will have a good time. Too often it is found that the saving habit has become so ingrained as part of his nature that it becomes positively hurtful to him to spend. He finds he has lost his power of enjoyment.

An over-strain of our physical powers soon manifests itself and can be remedied, but although much more serious in its consequences, undue and prolonged taxing of our mental force is often ignored until the breaking point is reached. Too close attention to business makes one stale, and there certainly cannot be maintained the freshness of mind that results from a complete change of thought. Except in cases of abnormal rush, home and business should definitely be things apart, neither overlapping the other.

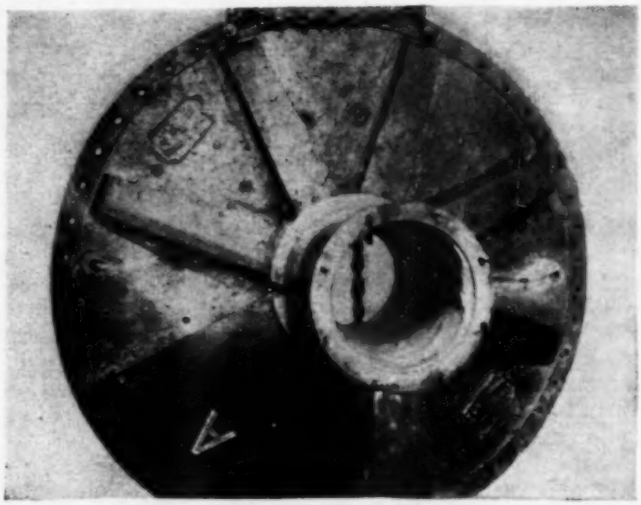
—T. H. HARGRAVE, *Lancashire, England.*

Welding a Tube Mill Head

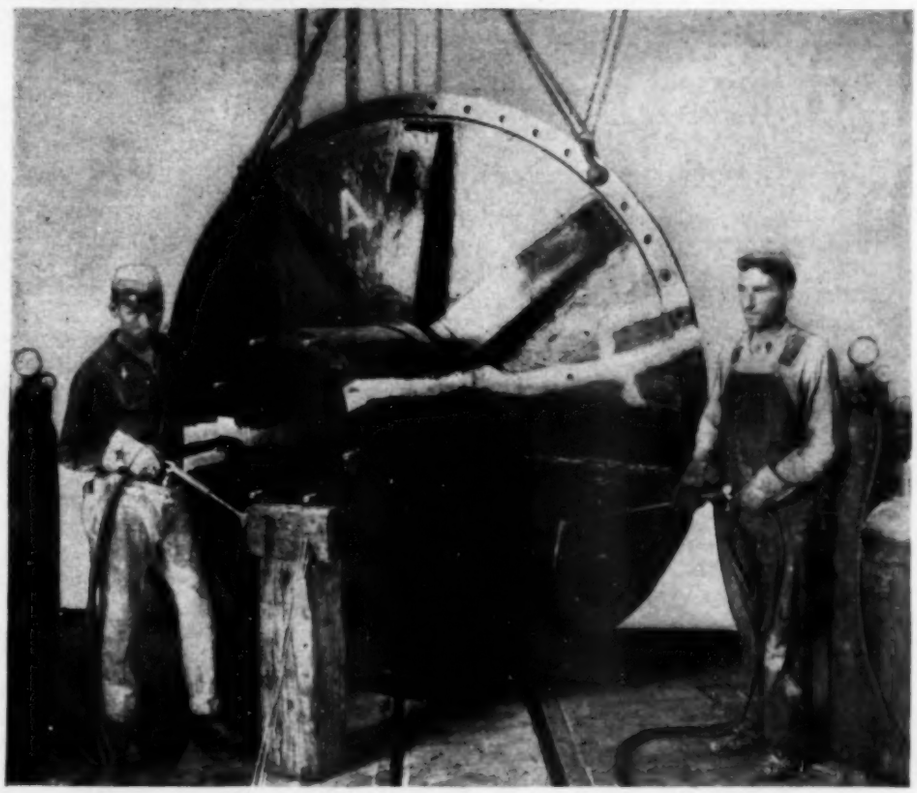
V. T. Root



This 4,000 lb. gray iron casting developed a crack after twelve years of service. The casting was heated at the rim, and the weld started at the end of the crack in the hub. However, the casting again cracked by pulling away from the welds



The second attempt was made by rechipping, preheating the entire casting, and rewelding. The piece was then covered with lime for fifteen days; the lime was removed only to find the casting cracked again



After some study, the head was cut entirely in two by extending the crack to relieve the terrific internal strain which made the first attempts futile. The weld was made using 225 lb. of manganese bronze. The casting is now in service and apparently is as good as new

Manufacturing Gears for Continued Accuracy

A. B. Cox
Consulting Engineer

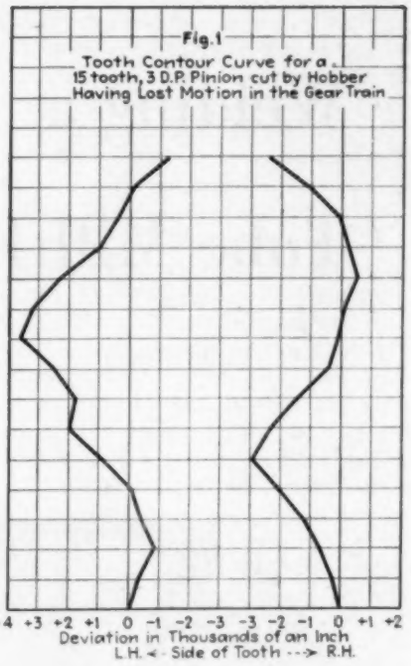


Fig. 1
Tooth Contour Curve for a 15 tooth, 3 D.P. Pinion cut by Hobber Having Lost Motion in the Gear Train
+4 +3 +2 +1 0 -1 -2 -3 -3 -2 -1 0 +1 +2
Deviation in Thousands of an Inch
L.H. <- Side of Tooth -> R.H.

THE GEAR problem has two parts—to make the gear accurate and to make the gear so it will stay accurate for a reasonable time. The first part has been given too much attention in some respects to the neglect of other features quite as important. The second part has until very recently been quite generally neglected.

While the careful grinding of hardened gears is a sure means of obtaining accuracy, particularly in those that are hardened after cutting, it is not a guarantee that the gears will stay accurate. If proper materials are chosen and proper treatment is given the materials, accurate gearing can be produced without grinding.

Several different types of machines for checking the accuracy of gear tooth contours are on the market. Figs. 1, 2, 3, 4 show the plots of some typical gear-tooth shape errors as determined by one of these machines. If each plot gave a straight vertical line, it would indicate that the tooth shapes were exactly correct. The amount of deviation of the plot from a straight vertical line indicates the error in the tooth shape. The error is plotted in thousandths of an inch against positions along the depth of the tooth. The top of the curve corresponds to the tip of the tooth and the bottom to a point near the root. The designation, R.H. and L.H. side of tooth, indicates opposite sides of the teeth.

Fig. 1 shows the errors in a pinion cut on a gear hobber with a large amount of lost motion in its gear trains. It is worth-while noting that the same error curve was found in these pinions regardless of which hob was used to cut the teeth. Fig. 2 shows the smaller errors in a gear cut on a hobber after most of the lost motion had been taken out and some of the more glaring inaccuracies removed. Fig. 3 shows the errors in a pinion hardened after cutting on a new gear shaper. The pinion whose tooth contour curves are shown in Fig. 4 was cut on an old rotary cutter machine.

For accurate gears the generating method is used rather than the formed cutter. Aside from the difficulty of obtaining a formed rotary cutter of the proper shape, both when new and when the cutter is old and ground back to the scrapping point, the chief problem is to center the cutter properly on the blank to be cut. Especial pains were taken to center accurately the gear shown by Fig. 4. The amount of leaning over of the contour curves indicates how much off center this gear was cut. One can guess about how much off center the ordinary product of this machine would be.

The difficulty of obtaining accurate hobs and shaper cutters that will keep their accuracy even when ground back to the scrapping point is similar to, but not so bad as that of the formed rotary cutter. While hobs and shaper cutters have to be sharpened properly or their accuracy will be ruined, cutter manufacturers generally have solved this problem and are able to advise their customers how to do this. Hob and cutter manufacturers are now able to furnish tools accurate within almost any number of ten-thousandths that the purchaser may care to specify and pay for. Two ten-thousandths plus or minus is not at all an unusual figure for the accuracy of some commercial cutters. However, old cutters, particularly hobs, may not have anything like this accuracy. Until a few years ago the fundamentally correct shape of the hob tooth was not understood. Those who wish to study this subject in detail are referred to "Problem of the Theoretically Correct Involute Hob," by Nikola Trbojevich, *Machinery*, Vol. 25, page 24. If a hob is made with a small thread angle, below five degrees, this error is usually negligible. Old hobs with a thread angle of more than five degrees should be looked upon with suspicion if modern accuracy is desired. However, machines are commercially available for checking the accuracy of hobs and of shaper cutters.

There is little uniformity of practice among manufacturers whose products require accurate gears. The automobile builders, for the most part, use gear-shaping machines while others make special hobbing machines or work over a standard machine to eliminate as many errors as possible. Figs. 5 and 6 show diagrams of the principal gear trains of some of the hobbers now in use.

Fundamentally, the problem of the hobber manufacturer is to keep an accurate hob on the hob spindle and an accurately centered and aligned gear blank on the work table rotating at a uniform rate of speed with respect to each other. This is not easy, as the slightest irregular or periodic speeding up or slowing down of the hob and work-table with respect to each other will generate the wrong tooth form on the gear blank. There are a number of factors which tend to produce exactly this sort of irregular motion. Eccentricity or other tooth contour irregularities in any of the gears of the train connecting the hob and work-table will cause irregular

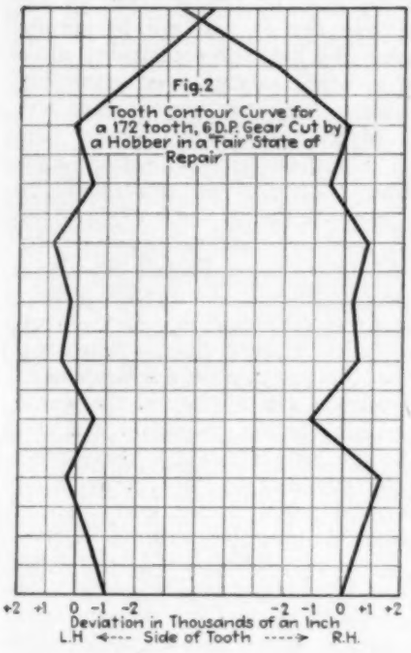


Fig.2
Tooth Contour Curve for a 172 tooth, 6 D.P. Gear Cut by a Hobber in a "Fair" State of Repair
+2 +1 0 -1 -2 -2 -1 0 +1 +2
Deviation in Thousands of an Inch
L.H. ←--- Side of Tooth ----→ R.H.

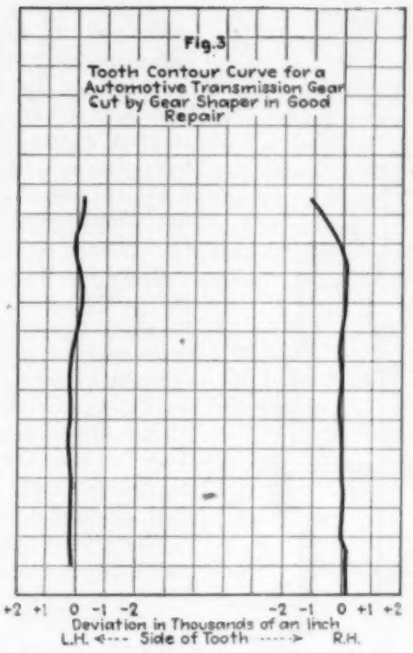


Fig.3
Tooth Contour Curve for a Automotive Transmission Gear Cut by Gear Shaper in Good Repair
+2 +1 0 -1 -2 -2 -1 0 +1 +2
Deviation in Thousands of an Inch
L.H. ←--- Side of Tooth ----→ R.H.

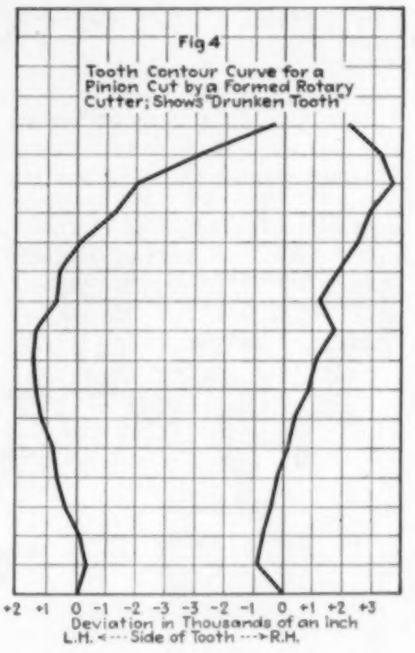


Fig.4
Tooth Contour Curve for a Pinion Cut by a Formed Rotary Cutter; Shows "Drunken Tooth"
+2 +1 0 -1 -2 -3 -3 -2 -1 0 +1 +2 +3
Deviation in Thousands of an Inch
L.H. ←--- Side of Tooth ---→ R.H.

rotation of hob and table with respect to each other, and a correct tooth form cannot be generated. Hence, the first essential in hobbing accurate gears is to have accurate gears in the hobbing machine itself. The gears should be amply large and made of proper materials so they will not wear rapidly, and furthermore, should be so designed that any wear that does occur is uniform.

If any gear manufacturer thinks that this is not a serious problem, let him visit his repair foreman and inspect some of the worn hobber gears that have been replaced. The appearance of some of the replaced gears will be shocking to anyone who is expecting accuracy from his machines. A low-speed speed indicator held against the end of the table drive shaft, while the hobber is taking a heavy cut on a pinion having a small number of teeth, will indicate whether or not there are large or periodic variations in the speed of rotation of this shaft. The evenness of rotation of the other shafts of the hobber can be tested in the same way. Such a test frequently makes one wonder how the gears produced are even passable. Evidently there must be an averaging of this error as the hob feeds across the face of the blank.

Attention has been given by some manufacturers to securing accuracy in the table drive worm and worm wheel and in the feed screw. This is important, but it is just as important to eliminate inaccuracies elsewhere in the gear train connecting the hob and work-table. Errors caused by feed or lead screws are gradual, so that the tooth contour on the gear varies between one end of the tooth and the other. Usually, however, the characteristic error in tooth form extends entirely across the face of the gear, and is not primarily caused by lead-screw errors.

Just as important as having an accurate gear train is the reducing of backlash and lost motion. It is characteristic of all generating cutters to cut the gear blank more on one side of the center line of the cutter and work table than on the other side momentarily and periodically as the gear blank and cutter rotate in contact with each other. This results in the cutting action of the hob rapidly thrusting the gear blank first in a clockwise direction and then in a counterclockwise direction. If there is any looseness in the gear train connecting the hob and work-table, the rotation of the gear blank will be periodically slowed down and speeded up with respect to the hob rotation so that an incorrect tooth contour will be generated.

Contrary to the belief of some operators, centering the hob on the gear blank does not and cannot avoid this difficulty. Tests also show that taking a number of cuts may aggravate rather than improve this condition, even though the finish is better and the tooth has a better appearance. In some types of machines, an indicator may be attached to the hobber head, and by slipping off one of the cutter drive gears, holding the other cutter gear from rotating, then driving the hobber head up by means of the quick-return motion, the indicator can be made to measure the smoothness of tooth finish as well as some other features of either spur or helical gears. The end thrust on the hob due to the cutting action must be solidly taken by adequate means; there must be no lost motion or spring.

Flywheels have been used in attempts to steady the motion of hob and table, but as a rule, they have not been applied correctly. For example, some apply a flywheel geared to the hob as indicated in Fig. 6. In a test, this flywheel proved to be practically useless as a means of improving the accuracy of the generated tooth contour.

Because of backlash in the gears between the hob and the flywheel, there was no perceptible steadying effect of the flywheel on the hob. Unless means is provided for taking up the backlash as the gears wear, it would seem to be useless to attempt to steady the motion of either the hob or work-table by a geared flywheel. And a flywheel attached directly to the hob or table would rotate at too low a speed to do much good except over a long period of time as noted further on. In the general application of flywheels to steady the rotation of any part of any kind of a machine, it does not seem to be generally recognized that each rotating member with its shaft has one or more critical torsional vibration periods. If the flywheel happens to bring the critical period of the member closer to the period of the disturbing force, the

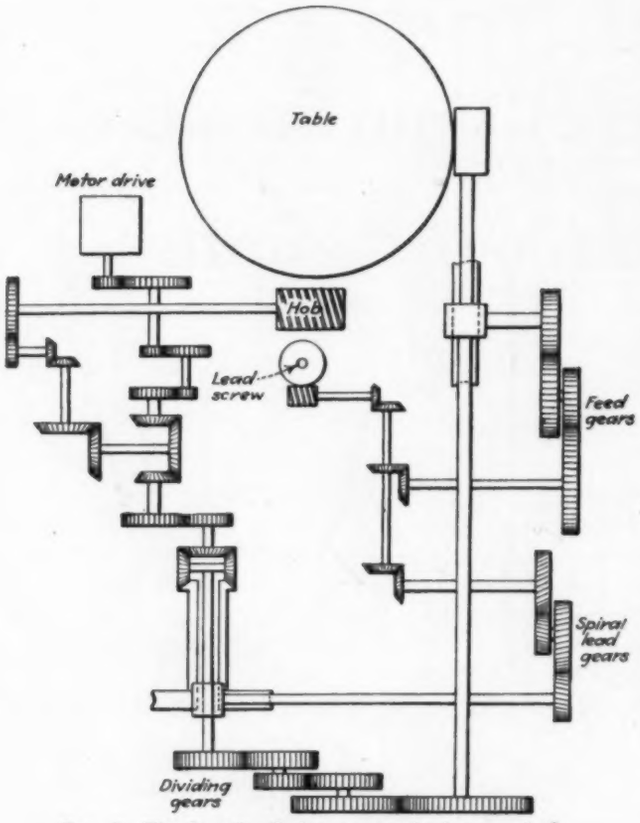


Fig. 5—The length of the gear train in a typical hobbing machine allows great opportunity for error

unsteadiness of rotation will be increased, not decreased.

Torsional vibration has been particularly troublesome in Diesel and other internal combustion engines, particularly where the engine has had to run at different speeds or loads or both. Because of shaft breakages, bearing failures, and the like, Diesel manufacturers have had to learn how to handle this vibration problem. But the application of this knowledge has not yet spread very far in the solution of similar problems in other fields of practical mechanics. Flywheels should always be calculated to avoid this critical resonant vibration. A simple explanation of this action is given in "Mechanical Resonance," *American Machinist,* Vol. 69, page 848, and formulas for calculating such flywheels are given in the book, "Vibration Problems in Engineering," by S. Timoshenko. It is obvious that even slow-speed flywheels, properly designed and applied, by exerting a continuous small steadying effect on the rotation of hob and table, will tend to wear down the inaccuracies of the gear train which are causing the irregularity of rotation. With the fundamental principle of having a tight, accurate gear train connecting the hob and work-table in mind, a glance at Figs. 5 and 6 shows the desirability of eliminating as many gears and joints in this train as possible.

Only bare mention will be made of such obvious points of accuracy as firm clamping of the gear or pinion blank to the work-table in such a way that it will not be sprung out of shape; indicating the hob for eccentricity after mounting in the hobber head; salvaging or discarding bent hob arbors; finish turning the bottom face and at least a small part of the gear-blank diameter true with the hub bore so that these surfaces can be indicated to secure accurate placing of the gear blank on the table; reasonable maintenance of hobbers; and the employment of trained, intelligent, and habitually careful machine operators. A slightly more difficult precaution is necessary in the case of pinion blanks that are already keyed to the shaft or are integral with it. If the shaft leans away from the vertical a slight amount when it is secured in the overhead support and to the work-table, indicating the shaft journals will not reveal this error. If the pinion is cut in this position, the result will be a very serious error in the pinion tooth, which cannot be compensated for by any sort of care in mounting and aligning the gear and pinion in the gear case.

It goes without saying that gear shafts should be accurately pressed in the gears; gear cases should be designed strong enough to be free from objectionable spring, accurately machined as regards center-distance and parallelism of gear and pinion shafts, and assembled with snugly fitting bearings. Foremen who have not actually checked up their work in these respects have sometimes had an unpleasant awakening.

When gears are being hobbed with a single heavy cut, chips from the gear blank frequently weld or freeze to the cutting edges of the hob teeth. On becoming oil hardened by the cooling stream, they are carried around to the gear blank again where they cut into the tooth contour producing rough tooth. The hob cooling system should be so arranged as to detach these chips from the hob teeth before they have time to weld fast. Not only will this increase the accuracy of the gear cutting, but it will also increase the life of the hob by increasing the time between sharpenings. When hot chips weld to the cutting edges of the hob, the heat draws the temper of the teeth and the resulting soft cutting edges dull rapidly. This dulling takes place even when there is a continuous full stream of cooling oil flowing over the hob and the hot chip. While the above discussion has been on the gear hobber only, most of the same general principles also apply to the gear shaper.

It is next to impossible to correct successfully the tooth contour by filing, scraping, or by any other hand operation. Some mount the gear and pinion either on

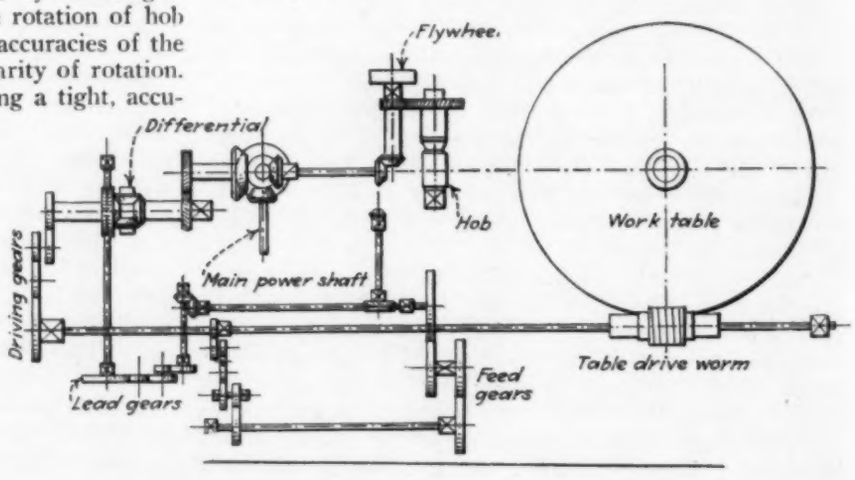


Fig. 6—A flywheel may be used to correlate the motion of hob and work table, but if incorrectly applied, may have harmful results

their own bearings and in their own case or in temporary bearings and run them under part load with some sort of abrasive material between the teeth. This method can be counted on only to remove small irregularities. It cannot correct the general tooth contour in any helpful way. It is much easier to ruin a gear set by this method than it is to better it. Without special arrangements, the grinding material will get into the bearings and grind them also. Then too, the set has to be completely disassembled and all the grinding compound thoroughly washed out. For this reason, emery should not be used. The most successful method seems to be to run the gears for a few hours at fairly slow speed under just enough load to hold the gears steady, with very fine ground glass in an extra light lubricating oil. The grinding should be stopped before the tooth surface is entirely ground. Burnishing can be used to advantage when a given gear design is produced in large quantities.

It is worse than useless to make gears accurate unless they can be made to stay accurate for a reasonable length of time. A specific example is that of some 30-in. cast steel gears that went out of shape almost immediately after they had been cut. The warping was as much as 0.011 in. on the diameter and 0.020 in. on the side. These gears had been given a regular commercial anneal and a hardening treatment before cutting. When the gears were put in their case and run in both directions under a heavy load and then taken out and recut, they showed no further signs of distortion. This was expensive. The clue to the solution of this problem was found in Dr. Geo. L. Clark's book, "Applied X-rays," on page 233, and the solution is applicable to the prevention of warping of steel used for any purpose. Dr. Clark says, " . . . the last traces of asterism, or strain in steel castings are remarkably persistent. In a comprehensive study of the effects of annealing upon fine structure, it was found that for blocks only ½ in. thick, heating for 20 hr. at 1,652 deg. F. was necessary for removal of the last traces of inhomogeneity, although improvement was observed successively at intermediate times. Changes in the particle size and strain during annealing and the effects of the method of cooling, either slowly in the furnace or by quenching in air, water, and oil, were all easily determined by the X-ray diagrams." It is not necessary to remove the last trace of strain for commercially perfect gears, and modifications of this annealing practice are possible in practice. In most cases, a little higher annealing temperature or a longer soaking time is sufficient to solve the problem without making the steel coarse and brittle. After annealing to remove the unequal strains of forging, rolling, or casting for gears that are to be hardened after cutting, care should be taken that other strains are not induced during the cutting process. For automotive gears made in large quantities, manufacturers of blank forgings are able to furnish steel of such uniform quality that change of size at heat-treatment is practically constant and can be allowed for in the cutter if desired. There have been numerous articles on this subject. "Metallurgical Problems of Transmission Gearing," by E. F. Davis in the Transactions of the A.S.S.T.—1928 is of interest.

Tests have shown that gear-tooth wear is primarily caused by pressure between the teeth, not to sliding velocity as might be supposed. This does not mean that sliding velocity has nothing to do with wear, but only that its effect is relatively unimportant as compared with that of tooth load pressure. To quote only one authority, the University of Illinois Engineering Experiment Station Bulletin No. 149, July 20, 1925, page 56, C. W. Ham and J. W. Huckert say in the summary of their test results: "Apparently, for any pair of gears, there is a critical surface pressure governed by the properties of the materials above which the life of the gears is short and below which the gears will run indefinitely without appreciable wear."

Theoretically, if gears could be designed so that the load pressures would be always carried by two teeth the wear should be more uniform than with present stand-

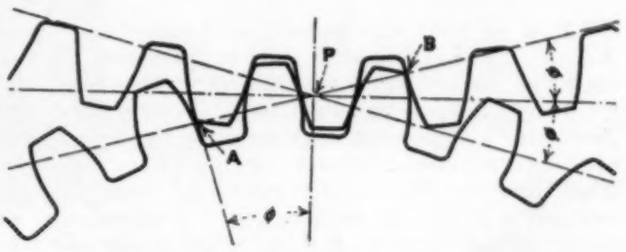


Fig. 7—Integral contact gears have greater accuracy and longer life

ard tooth forms, and a larger load could be transmitted by a given set of gears with the same wear as present standard tooth forms have, or with the same load, the wear should be much less than with present standard teeth. Shop tests and commercial applications of gears so designed have proved this theory to be correct. Gears so designed that the load is always shared by two teeth have been given the name of integral contact. Fig. 7 shows the tooth contact of a set of integral contact gears which have been run for over a million car-miles in actual service on an interurban railway, whereas for ordinary gear designs 300,000 miles in this service is considered to be an exceptionally long life. Not only has the wear on these gears been very slight, but the teeth have not worn out of shape.

Shop tests and commercial applications of the integral contact gear system, from automotive transmission gears to heavy, high-speed electric locomotive gears, have shown the same consistent results. Incidentally, these integral contact gears are slightly more efficient and much stronger, particularly for shock loads, and are quieter in operation as well as much longer lived than standard non-integral contact gears. Aside from this method of designing, the efforts of gear engineers to prevent irregular wear of tooth contour have been directed almost wholly toward the minimizing of all tooth wear by using hardened steels and by designing for comparatively light loads. Neither of these two methods is very economical. If it were now standard practice to design gears to have a constant whole number of teeth continuously in contact, it would be considered to be the height of folly to design as is now commonly done so that one tooth would be out of contact a short part of the full contact period. This practice decreases the strength of the set, increases the wear, and make the gears much more subject to vibration and noise without gaining any offsetting advantage. Additional details of some of the means of making accurate gears are given in "Eliminating Noise in High-Speed Gearing," by Ira Short, *Power*, Vol. 67, page 761. The decided operating advantages of long and short addendum gears cut with standard cutters is

explained in "Long and Short Addendum Gears," which appeared in *American Machinist,* Vol. 74, on page 196.

The higher the speed of a gear, the more care is needed in mechanical balancing and in proper lubrication. In present practice, most gears are not balanced at all, and some run at such speeds that the lubricant is practically all thrown off the teeth by centrifugal force. Fortunately these are not often serious sources of trouble. If as much care and expense were put into the production of an accurate gear in the first place as is put into the production of an inaccurate gear and its correction or replacement afterward, the problem will be more satisfactorily solved.

Tintypes and Tools

BACK in 1879, two general machinists, Millholland and Mathews, opened a shop in Baltimore. In this shop they constructed a machine for cutting gears and graduating instruments for the U. S. Navy, and also performed a number of experiments in the development of currency printing presses for the U. S. Treasury. This latter development was conducted with elaborate safeguards to prevent unintentional "disappearance" of either the special paper or dies. Other contributions to the mechanical arts included a high-speed piston valve steam engine, a safety trip for planers, improved rivet-making machinery, automatic knitting machines, improvements in steam and air-operated rock drills and machine tools.

The W. K. Millholland of the story is leaning on the canopy post of the tintype. At his death in 1916, his son, with the same initials, took up the work, assisted by four brothers, all trained in the mechanical arts. The company name is now "The Millholland Sales & Engineering Company," the offices are in Indianapolis, and the organization is in its 52nd year.

W. K. Millholland was one of the original subscribers to *American Machinist.* Once when an editor of the magazine visited the Falls Rivet & Machine Company near Cleveland he asked for Mr. Millholland, then superintendent. He was advised to "look for a man reading the *American Machinist* as he walked home to lunch, and he'd have his man." Being a good editor, he did as directed and stopped a man on the street with, "Mr. Millholland, I'm glad to meet you." He had his man, and the two became lifelong friends.

■

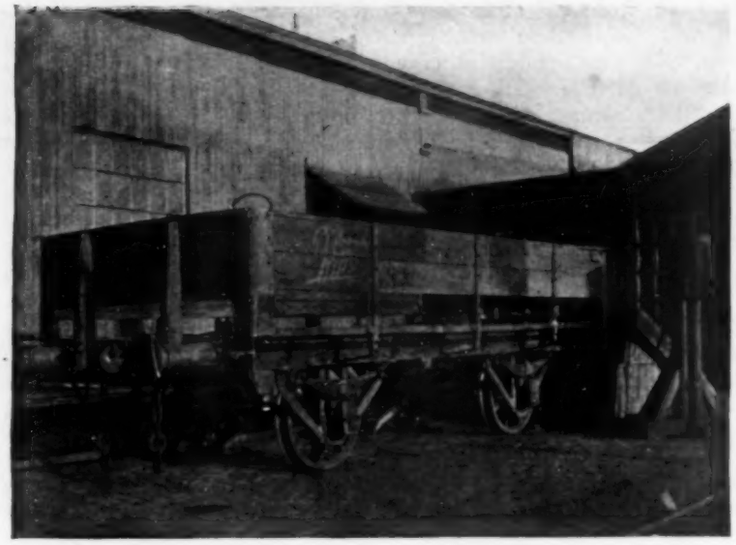
Cylinder Liners for Navy Diesels—*Discussion*

CHARLES H. HUGHES
Consulting Engineer

LIEUT. COMMANDER J. F. Crowell's article under the above title on p. 875, Vol. 73, of *American Machinist,* recalls various experiences we had at the Shipping Board on Diesel engine liners for the main engines (2,500-2,800 B.hp.) installed in the Diesel conversion program. When the orders were awarded to the engine builders, many thought it would be extremely easy to cast liners to meet the high temperatures and pressures, but they soon found out differently. These liners were approximately 33 in. inside diameter by 60 in. long, and 1¼ in. thick, the dimensions varying for different engines.

One foundry used 10 per cent charcoal iron, 50 per cent Mayari iron, 40 per cent steel rails. To every 8,000 lb. of this mixture 15 lb. of ferro-chrome was added. Coupons tested as follows: Tensile 36,000, transverse 4,200, deflection 0.27, Brinell 212. Chemical analysis: Graphitic carbon 2.60, combined carbon 0.70, manganese 0.57, phosphorus 0.53, sulphur 0.08, silicon 1.10, nickel 0.30, chromium 0.72. Coupons from liners furnished by another foundry tested: Tensile 39,450, transverse 4,260, deflection 0.102, Brinell 217. Chemical analysis: Total carbon 3.06, manganese 0.60, phosphorus, 0.33, sulphur 0.11, silicon 0.99, nickel 1.65, chromium 0.26.

Because of the high Brinell there was difficulty in the machining. Measurements taken of some of the liners after being in service for about six months showed a growth in length. In others the inside wore slightly elliptical, but this perhaps could be laid to incorrect fit in the piston rings or faulty lubrication.



This second and final article describes current arc-welding practice on railways and tramways

Welded carriage frame in use on the Belgian State Railways

Arc Welding in Europe

E. Dacre Lacy
Alloy Welding Processes, Ltd.
London, England

In construction and repair of locomotives and rolling stock and in upkeep of the permanent way, arc welding is now utilized by European railways. Welding can be used on locomotive frames, cylinder running gear parts, smokeboxes, cabs, wheels and axles, boiler seams, pad and foundation-ring corners, boiler flues and superheater tubes, Flannery stay cups, domes, and similar parts. The British Board of Trade at present does not allow the use of welded joints in steam boilers to carry the principal load. However, it is predicted that it is only a matter of time until this body recognizes its value and outlines safeguards for its use.

Considerable preparatory investigation work has been done on welded railway cars. It is estimated that the welded car frame will be approximately half a ton lighter than the ordinary riveted frame, with actual cost somewhat lower. It will be necessary for the technical experts of the rolling stock factories and welding engineers to co-operate in the development of suitable jigs and clamps, means of slinging, and the provision of proper pits and stagings, in order that work may be presented to the welder in such a way that welding throughout can be done efficiently and economically.

In order to compare riveted and welded joints in the construction of railway "wagons," the Belgian State Railways recently built at their main workshops two 20-ton coal wagons, one entirely riveted, the other electrically welded throughout. Even though welding would have enabled the size of sections to be considerably reduced, the same sections were used for both frames because of the stock on hand. Buffers and drawgear were bolted in the welded frame and horn blocks were riveted. All other joints were welded. All gussets and angle splices were eliminated except the angles connecting the solebars to the cross ties and the corner gussets. The saving in material amounted to 12 per cent in favor of the welded frame. Erection was carried out without templets, the two solebars being maintained at the correct distance by cross pieces bolted to the horn blocks, and these cross bars in turn being connected by two diagonal struts to secure alignment. Under these conditions, the complete welding of the frame took 64 hours.

Arc welding has been proved particularly suitable for repairing heavy parts on steel wagons, and also for repairs where a weld of great strength is required. Cracked or broken spring buckles may be built up easily, as may axle boxes, axle journals, and axles. Cracked or broken buffer heads, bottoms of buffer bodies, or cracked or broken buffer cases may also be repaired, as may draw hooks, drawbars, brakes, and pull rods.

The first arc-welding job executed by the Belgian State Railways was in May, 1920. Since then all repairs

One type of steel sleeper for railway service

of steel fireboxes of locomotives have been done by arc welding. This includes welding of broken parts in wide variety, repair of chipped and worn parts, such as piston rods, driving connection rods, coupling rods, crankpins, and also parts of the track such as broken sections, pedal boxes for points, signals, latch bars, iron stairs, piping barriers, and weighing machine frames. In general, the upkeep of trackwork has so far been carried out in special workshops where damaged parts were collected. The tendency is, however, to extend the process. Repairs executed on the spot will enable avoidance of costly dismantling and will result in a considerable time saving. The necessary equipment is not a very great item. The Belgian Railway already has portable electric welding sets installed in traveling breakdown vans, and these sets have rendered valuable service. Welding has been utilized by some of the Italian railway companies for joining electric joints on rails. Instead of the electric joint being fixed with a conical copper journal at the work of the rail, Italian engineers have adopted the system of welding at the rail-head, the electric joint consisting of two iron sheets in which copper strips are pressed. Welding has usually been carried out by means of a motor-generator set, the motor receiving current from the aerial wire. In nearly every case the welding plant is transported along the rails, and in several cases by means of self-propelled cars.

Within the last year or so, steel sleepers have been advocated in England. They have been in use in Germany for some time on main-line tracks. During the last three or four years, more than a million steel sleepers with electrically welded bearing plates have been laid on German State Railways. The design has passed the experimental stage, and this type of sleeper is now a recognized standard.

In many countries, railways prefer to attach the rail to the sleeper by means of taper steel wedges and keys, driven between the rail flange and lugs pressed up from the metal of the sleeper. Forming of these lugs reduced the strength of the sleeper to such an extent that the thickness of the metal along the top of the sleeper has been increased from $\frac{3}{8}$ in. to 7/16 in. and finally to $\frac{1}{2}$ in. for 90-lb. rails. To suit this type of sleeper, designs have been prepared embodying electrically-welded bearing plates rolled with shallow flanges which are formed into lugs, and it is considered that a thickness of $\frac{3}{8}$ in. along the top of the sleeper will be sufficient, representing a saving in weight of 25 lb. per sleeper. The bearing plates may be cut off square from the rolled section and fixed at an inclination to the center line of the sleeper to suit the taper of the keys, and they may be sheared at the angle equivalent to the taper of the keys, the sides of the plate then being parallel with the center line of the sleeper.

For "Bull-Head" rails, a British firm of engineers is using a steel chair built up from two rolled sections and specially designed for welding to a steel sleeper. At one time, Indian railways used cast-iron pot-sleepers deliberately designed to provide a very wide rail seat, but experience showed that the track was greatly improved by reducing the seat width to 4 in. or even less, using flat-footed rails. For this reason, the new "Bull-Head" rail has a $4\frac{1}{4}$-in. face on the mild steel chair. It is expected to have less wearing effect on the foot of the Bull Head than the $7\frac{7}{8}$-in. face of the standard cast-iron chair, with its excessively hard skin. In other words, the steel chair itself will wear, whereas the cast-iron chair will wear the rail. It is estimated that a sleeper of this type can be produced at approximately the same cost as that of an ordinary creosoted timber sleeper complete with chair and fastenings.

Welding Practice on Street Railways

In the construction and repair of tramway rolling stock in the shops and in the repair and upkeep of the permanent way, arc welding is now much used by tramway undertakings. The expense of maintaining rolling stock is in itself a material item in running costs, and in many cases arc welding has been adopted to lessen the working expenses while improving the quality of repairs.

Tramway rolling stock is subject to continuous service under particularly severe conditions. A number of parts are, therefore, liable to breakage, damage, and wear. Because of the great variety of repairs, repair shops cannot employ mass production methods. In order to minimize time, tramway repair shops formerly had a large stock of repair parts which could simply be used to replace those broken or scrapped. The use of arc welding has obviated this necessity.

It frequently happens that arc welding enables expensive materials to be saved, as for example in the case of 25 new controllers found to have the rectangular sleeve for the controller handle 90 deg. out of standard position. To dismantle all the segments in the controller would have been a long costly, job, whereas, by arc welding it was possible to build up the sleeve to cylindrical shape and then cut it in the milling machine to suit the standard position.

Fresh applications of arc welding occur daily. One leading English tramway found cracks in the built-up solebars of 23 cars after only six months' service. These

Left—Car wheel to be repaired by welding

Right—Car wheel after welding has been completed

Another type of steel sleeper, also with electrically welded bearing plates

cars were kept running, but as it was feared that the sole-bars might break down altogether, it was decided to carry out a quick repair. In order to avoid dismantling, the welding was done over an inspection pit after cutting chamfers with the arc and with a chisel. The head welder had the cars run into the workshop one after the other at intervals of half an hour. The complete repair, including cutting chamfers, only took 30 min. per car, and required only five or six electrodes for each crack.

Greater progress has been made in welding work undertaken by tramway companies in Belgium, Italy, and France. Wheel tires and flanges are subject to fairly rapid wear because of the action of the brakes and friction when traveling around curves. Also flat spots are frequently formed on the tread, and flanges may become worn on both sides either by friction against the rail flange or against the edge of the rail groove. The former method for making these repairs was turning the tire down in the lathe. Obviously, the number of times a tire might be reconditioned by turning down was limited. Usually, the tire was turned down three times and then scrapped. By electric arc welding the tire may be brought to practically the original dimensions by merely building up the worn parts at a cost of less than one-third that of turning.

Three different methods are used in building up tires. In one, a light cut is taken on a tire in order to remove the flat spots and to regain the desired taper. The shoulder of the flange is then built up and, if necessary, the other side of the flange. The method most used in Europe requires the wheel set to be removed from the car and the wheels and axle fixed vertically over a pot, the parts first being cleaned with a wire brush. Upper surfaces of the flange are then built up, the operator working alternately on the bottom and top wheels. Building up is done on diametrically opposite parts. In this way heating of the tires is avoided without reducing the working speed, and there is no fear of the wheel centers becoming loose. The third set-up permits the wheel to be kept in the horizontal position on the rails. They are then rolled along so that the part to be built up is always horizontal at about the highest point of the tire. The difficulty with this method is that passing from one point on the tire to a point diametrically opposite is slower that when the axle is fixed vertically.

Besides ordinary wear, journals are likely to seize and to develop grooves owing to abnormal stresses. These are built up by arranging the axle horizontally. All grease is removed from the journal and welding is then built up on the outer shoulder in a circular strip. The same operation is carried out in the inner shoulder, proceeding by quarter turns in order to avoid heating of the journal. These two ring deposits are then joined by continuous longitudinal strips. Care must be taken to arrange the deposits one after the other without space between them, which would have to be filled up afterwards, because the process of filling up would require too much current for fusing the surface of the journal and the two ends of the deposits.

Motor casings, without being broken, frequently become considerably worn at the bearings. Arc welding has been particularly useful for building them up. Even the cast steel shell of bearings lined with anti-friction metal may be built up. One leading tramway company recently carried out an important alteration in a number of motor casings. In order to standardize the various types of gearings, it was necessary to bring the axis of the motor and the center line of the axle $\frac{3}{16}$ in. closer together. This was done by building up one-half of the bearings in the casing and then reboring and planing the bearings.

Tramcar gears usually consist of a center in two halves, each fitted with a toothed rim of special hard cast steel. The toothed rim is fitted to the center by a dove-tail joint, and shrunk on hot. In spite of this complicated fitting, the joint cannot stand up under the violent shocks under sudden starting and electric braking. The toothed rim may be prevented from sliding on the center by fixing it with a weld at several points on both sides. In new gear wheels it is more economical to replace the dove-tail joint by merely welding the steel rims to the centers. Turning, straightening, and milling may be done after welding. Newer gear designs have a center of disk type, consisting entirely of flat bars with plates welded on in sections. Transverse rigidity is obtained by means of ribs welded on. Gear wheels made by this method are remarkably light and strong. The same method may be applied to drawing pulleys, using pressed steel plate for the rim.

Loose joints in wooden car bodies are now reinforced by means of rigid angles consisting of flat bars braced by welded tubes. When axle box guides are much worn, they are reconditioned to advantage by inserting short pieces of channel iron in the grooves. In order to facilitate welding, the flanges of the channel irons are allowed to project slightly, and the opening of the grooves is slightly widened.

BALL and roller bearings require lubrication because there is considerable sliding or rubbing action in all types of anti-friction bearings. This metal-to-metal sliding contact requires lubricant to prevent friction, wear, and noise. A large part of the friction occurs between the rollers and balls, and the cage. This comes at the sides where the cage divisions push the rollers to maintain them in alignment and to keep them properly spaced, also at the ends of the roller to keep them lined up lengthwise. Further, there is friction between the balls and rollers in their races. For low speeds and heavy loads greases of various consistencies may be used to advantage. They should be properly selected as to consistency, fiber content, and lack of any free acids. Care must be exercised lest grease "channel out" or be pushed away.

The Foreman's Round Table

ON AGAIN, OFF AGAIN

ED WAS reading his mail as Al stopped in front of his new "open air" office. A deep frown was on Ed's face, and he did not notice Al until the latter spoke. "Morning, feller," greeted Al. "You are one of those guys that have a speaking countenance. What's bothering you now?"

"Oh nothing particular. It's just one damn thing after another. I'm getting so I hate to open a letter; it's bound to be either some one with a hard luck story, or else it's an accepted practice order from Williams. Just now it's a letter from Cy Melrose strongly intimating that he would come back if asked; in fact his letter is an application."

"I can't understand why you look glum at that. As I remember, Melrose was one of the many 'best mechanics you ever had,' and you thought the shop would have to close when he left."

"Cy was a good mechanic, but that don't alter the case. He quit, and as far as I am concerned he stays quit."

"My gosh! Not so long ago you nearly had spasms because Williams merely suggested that a foreman ought to be careful about rehiring men who had quit."

"I admit that; it was the principle I objected to. But I got to admit that every one I rehired quit me again, or else was not much good after he came back; so I made up my mind, once quit, quit for good."

"Suppose Melrose writes to the personnel department, and they hire him for you?"

"I'll forestall that by marking this letter 'not satisfactory' and sending it to the personnel man. I don't want him back ever. Nor any other man that throws me down."

"You'll be glad then, Ed, that Williams is going to issue an accepted practice order on that subject. He just had the personnel man and myself in his office. I have a rough copy in my pocket. Want to read it?"

"I might as well, I suppose, as to read it later and get all wrought up again. But I am serving notice that it does not apply to my department. Let's see it."

"Maybe I can read it better. I have my copy all marked up. Here goes: 'A firm that means to treat its employees with fairness and consideration must take into account the temptations to which they are subjected. This company has no objection to any employee leaving its service to better himself, or when he thinks he can do so. Where a vacancy exists it will give preference to such an employee if he wishes to return. In exceptional cases it may rehire a man the second time, but when any employee leaves the service of the company a third time he must consider it final. This does not apply to those men who are laid off because of slack work and accept positions elsewhere.' Personally, I think that's a darn good rule, Ed. When a man quits three times it's a habit or something worse. The personnel man objected to any restriction, but we were two to one, so he lost out."

"How does that affect me; do I have to accept a man whether I want him or not?"

"Williams expects his foremen to be square and have horse sense. Figure it out for yourself."

Is a blanket rule workable, or should it be left to the discretion of the one doing the hiring? In a community where labor is not plentiful will the rule restrict quitting, or will it cut down the available labor supply?

Suggested by W. J. Owens, Foreman, Newport Rolling Mill Company.

▸ ▸ ▸ Discussion of Former Topics

Wide Open

The plan of having the foreman's desk in the open on the floor of his department is a good one, but it is not an original idea.

Many shops for years have had their foremen so situated and have found that it is the correct place for them. These desks are placed according to the lay-out of the shop, but I believe the ideal location is in the front or center-side facing the men.

It was mainly intended that the foreman should stay in his department so the men could find him when needed and when another executive wished to see him about something—not that his presence there should put fear in the mind of the workman.

—Arthur E. Schimpf,
Cincinnati Bickford Tool Company.

By Their Presents

Twenty-five or thirty years ago there was no problem as to whether a present should or should not be given. As a matter of fact, seldom indeed did any executive receive a present from his men, except when he retired. Now, five or six times each year, collections are taken up on almost any pretext, in many cases by men who toady to any official who will let them. Eight or ten dollars a year from the pay of an official on salary may not be felt, but from a machinist or helper who does not get paid for holidays or for broken time, it is a serious matter. Collections for presents are seldom taken up to give to the executive who works in the best interests of the concern whose salt he eats. Why? Because he is all business, has no time to foster favorites, has no cronies among his men; his chief concern is getting the best out of men and machines.

The writer was engaged in an executive capacity in a large concern for a long period during which time a large number of presentations took place. In by far the majority of cases these were initiated by men who were unduly familiar with the executive for whom the present was intended. —A. Silvester, *Manager,*
Item Fiber Company.

The End of the Road

Williams has the right idea. Vacancies should be filled by promotions inside the organization when at all possible. Opportunities of future advancement will do more toward holding good men than any other one thing. We all like to believe that we are going to advance up the ladder of success. Of course no promise can be made specifically, but all of the men should be urged to become qualified for something better, in case the opening should occur. Occasionally the men should be given work to do which they have never or seldom attempted before in order to get their reactions to different and new experiences. Thus, a basis will be established upon which to determine their spheres of future usefulness. The foreman should readily recommend a man for advancement or transfer. He should not keep a man down merely because the man is expert at some certain work, but should take pride in advancing his men as speedily as their ability and the openings in the organization justify. —L. O. Brown.

Age and Its Compensations

The fairest system to the worker as well as the employer is to have a certain rate set for each job and the same rate paid regardless of who performs the work. The manufacturer gets a certain price for a machine and so long as he produces the machine at a price that will net him a reasonable return, the age or past experience of the man building the machine should be of little interest to him.

In nearly every shop there are certain operations performed on specific machines. The same class of work comes to each machine regardless of whom the operator happens to be, so the fairest method is to set the price on the work rather than on the man performing it. Knowledge and skill should be taken into consideration by tactful placing of the men. The better qualified men should be given the more important jobs, which should naturally pay a higher rate. Seniority should not be overlooked entirely, because the firm disregarding seniority is very apt to have dissatisfied employees and increased labor turn-over. —W. J. Owens, *Foreman,*
Newport Rolling Mill Company.

The Exception to the Rule

The most difficult problem in setting up any incentive scheme is to decide what increase in the daily rate of the worker of average ability is considered desirable. The company wishes greater production per man, and the men have to put in greater effort or improve their skill to achieve this. In fairness to every one the price setting must be based on the average output which the company would obtain from the man of average ability on a day rate. This means that the average man will need to work harder than he does when on a day rate in order to increase his pay. In this way a man who works no harder than usual would not earn more, and since the company's policy is greater production by more work per man, it becomes advantageous to dispense with such men.

If a price has been set which enables a particular man of average ability to earn considerably above the average earnings, it is quite justifiable to adjust the price to a new figure based on the output obtainable with the

effort normally associated with day rate labor. Such action is ethically sound since it avoids the unfairness in earnings between similar men. Where care has to be taken is in making certain that the rate is incorrect, whereas it may be that the man is displaying considerably more than average ability on the job in question. In one case I have in mind, a man's high earnings attracted attention to the price rate on his work. It was lowered, the man refused to accept the new price, and was transferred to another job. Three men in turn were put on his job at the new price and all just managed to earn their day rates. It proved to be to the company's advantage to return to the original piece price and bring the original man back to the job. This was done, thereby acknowledging that difference in earning power of the particular man over the rest of the men in the same department was not due to incorrect piece rates, but to his special ability on that class of work.

—S. A. KNIGHT, *Irak Petroleum Company, Ltd., Tuz Khurmatu, Irak.*

The Tower of Babble

Segregation of nationalities is a poor method of obtaining that co-operation which must prevail in any smooth running plant: it offers no solution to the problem of americanization.

In my opinion, the workshop, being the place where the foreign born employee spends a large part of his waking hours, is the logical place to inculcate the principles which are embodied in the constitution. To that end many corporations have devoted time and money in establishing and maintaining naturalization classes.

Shop discipline also demands that the alien element should conform to the same shop rules which are accepted by the native born American.

In my experience, I have found the average newcomer from the Old Country willing to assimilate any instruction that will make him a more useful citizen.

—R. S. ALEXANDER.

Going Soft

There is nothing soft about it, it's just common sense. I am well acquainted with a shop that has the reputation of being the steadiest in the city when it comes to all-year-around employment.

This is partially because of good planning and partially because the company goes the limit in holding the old timers together during slack times, giving them as much employment as possible.

In this factory, nothing extra is paid for overtime, just straight time and the men are glad to work beyond regular hours at the regular hourly rate. They prefer a steady job at a fair price to spasmodic employment with higher pay while it lasts.

Aside from the question of whether overtime should bring a higher rate or not, the fact is that in this shop the arrangement pays both the management and the men.

With the money saved on overtime during the year the company can afford to keep more men on the pay roll when business is not so good.

This is just a common sense arrangement for those who appreciate its advantages. Of course, it is rather tough on the floater. The scheme works well because of the shop's established reputation. —J. C. P. BODE.

Mechanized

Immediately we begin to think about the mechanization of industry we realize, first, that its results are complicated, and second, that it would be of advantage to the community provided that its results were controlled by one power, working solely for the good of the community.

While the competition of private enterprise exists the full benefits of mechanization cannot be felt by all.

Say that a thousand people living on a small island cut off from the rest of the world can live in a certain state of comfort by manufacturing or producing all their requirements, by working ten hours a day with primitive tools. By general consent it is decided to appoint a few of their number to design and make equipment or machines that will enable output for the same manual labor to be increased.

As the men engaged upon the manufacture of this machinery would not be producing the necessities of life, the standard of living of all would, for a time, be reduced if everybody worked the same number of hours, or the standard of living remain the same if hours of labor were increased.

Immediately, however, the new machinery became operable more goods could be produced with the same labor or the same goods with less labor. Therefore, hours of labor could remain the same and the standard of living increase or the standard of living remain the same and hours of labor decrease.

This is obvious. What, therefore, prevents the community benefiting by every improvement in machinery?

Unorganized private enterprise—for each enterprise considers only its own betterment, with the result that with any mechanization workmen are dismissed so that selling prices can be reduced with the object of increasing sales and so profits, or with the object of keeping prices the same and increasing profits.

The dismissed workmen receive no wages, therefore the total value of goods bought will decrease.

Again, then, must the amount of produce decrease and again the total wages paid will fall; and this must continue until no wages are paid and no work remains.

—HARRY SHAW, *Lancashire, England.*

Age and Its Compensations

Although uniformity of pay is necessary, there must be some compensation for the man who does his work more efficiently than the average.

In this case, any one of several incentive systems may be employed. With a good incentive system in operation, every man is sure of fair treatment in the matter of pay. Each worker gets exactly what he deserves. The efficient man is well paid, while inefficiency is discouraged by receiving small pay. Shop politics are excluded entirely from this method of determining payment. Further, skill, experience, and knowledge are all paid for on the basis of their value to the firm.

Although seniority should not affect the wage-scale, it must be evaluated by management. If seniority has no value, employees will be constantly going to other firms that offer a few cents more per hour, whereas if the worker knows that the length of his service has a dollars-and-cents value, he will be less interested in changing his job. —W. G. BARTOLOMAY, II.

New York, Corvallis, Atlanta, and Pittsburgh—

All Discuss Welding

A resumé of recent papers on welding and weld testing presented before conferences and meetings throughout the United States

Automatic welding of a tank

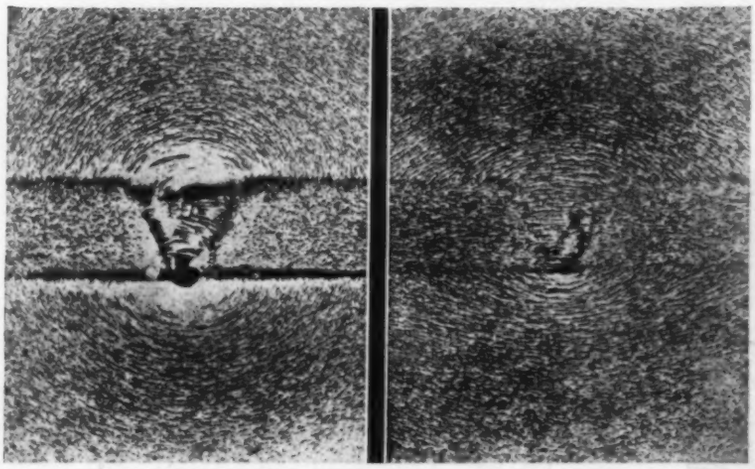
NON-DESTRUCTIVE tests of welds were discussed at the March 9 joint meeting of the New York Section, American Welding Society, and the New York Chapter of the American Society for Steel Treating. Methods described included stethoscope, magnetic, X-ray, and gamma ray. Stethoscope tests are being used with success in testing structural welds in buildings, pipe lines, and other work, sometimes as a preliminary to more close partial examination by X-ray. Magnetic testing has been aided by application of a non-magnetic, lubricatory coating to the iron particles which permits them to assume their pattern quickly and also gives them a grayish color which makes the pattern distinguishable against the ordinary steel surface. A. C. current is being adapted to this method, the alternations of the current being used to "joggle" the grains into the pattern quickly.

X-ray testing has proved of value for testing thinner weld sections, such as those in pressure vessels. It can be used in production work at a rate of 1 ft. per min. through 1-in. steel, but if the thickness is increased to 3⅛ in., the rate is but 1 ft. in 20 min. Theoretically, if the thickness were increased to 6 in., it would take 500 hours to examine 1 ft. of weld. Gamma rays, according to Dr. R. F. Mehl of the Naval Research Laboratory, are more serviceable in heavier sections, permitting inspection of sections up to and thicker than 7 in. with ease. The Navy has used them with success in inspecting steel castings and welds. Faults are less distinguishable than in X-ray tests, and the present price of radium, around $70,000 a gram, makes the investment comparatively great, but the process has the advantage of being applicable to a wide variation in sections and is readily portable. In addition, radium has a useful life of something over 1,600 years, meaning little depreciation in investment.

J. R. Dawson, Metallurgical Engineer of the Union Carbide & Carbon Research Laboratories, in a paper at the Pittsburgh Regional Meeting of the American Society for Testing Materials, "Stethoscopic Examination of Welds," gave more data on testing use of the stethoscope. A cone-shaped endpiece of soft rubber, fitted over the hard rubber end of an ordinary physician's type stethoscope, prevents undue damping of vibrations when the stethoscope is in contact with the metal. Mr. Dawson also described the variation in sound created by the bad spots in a weld, and explained some of the erroneous results attained in inspection by this method.

T. R. Watts, Research Engineer for Westinghouse, in another of the A.S.T.M. papers, "Magnetic Methods of Testing Butt Welds," described his application of the method and showed a number of illustrations of typical tests to show the types of faults detected. He found magnetic tests better than thermal, aural, or electrical methods for testing butt welds. He used iron grains sprinkled over a weld section painted white. If a permanent record was desired, he sprinkled the iron grains on a sheet of Van Dyke paper, and after the pattern had formed, exposed the paper to a twin-arc lamp using therapeutic carbons. For surfaces which were not smooth and faults far below the surface a "weld test meter," a simplified Koepsel permeameter, proved satisfactory, and could be used in any position.

T. M. Jasper, Director of Research of the A. O. Smith Corporation, described fatigue and impact testing of welds in still another A.S.T.M. paper. Fatigue and impact tests on a material do not correlate until the energy of the impact blow approaches a very small value. The fatigue test is of little value in inspection, and



"Third dimension magnetographs of a bad [left] and a good [right] weld, made on the edges of test specimens"

impact testing is a good indicator of toughness in welds.

S. H. Taylor of the Engineering Division, Lincoln Electric Company, in a paper, "Welding With the Shielded Arc," before the Annual Conference on Welding Methods at the School of Engineering, Oregon State Agricultural College, berated the manufacturers and salesmen of welding equipment who make extravagant claims and rash promises. He says: "Several causes may be assigned to welding failures and the absence of expected economies. Among them we find the manufacturers and salesmen of equipment who claim that the solution of every fabricating problems is to weld. Years ago this excessive enthusiasm may have been necessary; pioneering requires much optimism. . . . Most important and most neglected has been the responsibility of the management. It is not uncommon to find executives of concerns whose chief means of metal fabrication is welding ignorant of many of the fundamental principles involved, having no adequate procedure control; and buying welding materials because Bill Smith is selling them, particularly if Bill's price is a little lower."

R. W. Van Kirk of the Industrial Department, General Electric Company, discussed "Arc-Welded Joints in Steel Structures" before the Welding Conference at the Georgia School of Technology, Atlanta. Explaining points which welding inspectors must watch, he said, "The first requirement for fusion is, that the weld must make a smooth fillet where it joins the plate. It must not overlap, i.e., appear to roll over on the plate, but should be a continuation of the plate metal. A common test is to place a knife blade at the edge of the weld. If it can be inserted at all under the edge of the weld metal, improper fusion has occurred. At the point where the arc strikes the plate, the plate metal is melted and is forced out of the molten pool by the arc. This crater will be found at the point where the weld was finished. It can also be noted while welding and when the operator is changing electrodes. Its depth and general shape provide a means of judging the penetration and fusion, and of predicting the soundness of the weld. Its depth in general should be at least $\frac{1}{16}$ in. It should be neat and circular in shape. If it is small, relative to the size of the bead, the welding current should be increased; while a large elongated crater would indicate too much current.

"If a reliable, uniform, welding electrode is being used, with the proper current, and a spattering of large globules of metal is found near the weld, it indicates a long arc.

"The sound of the arc is also a good criterion of the quality of the work. . . . A good weld on clean material, with the proper current, is indicated by a rapid, sharp, sputtering, and crackling sound; a long arc will be accompanied by a hissing sound. An unsteady arc will result in intermittent crackling, hissing, and breaking of the arc. This same result will also be obtained with an improperly cleaned joint."

In summarizing their A.S.T.M. paper on "The Quality of Materials for Fusion Welding," C. R. Texter and F. N. Speller of the National Tube Company, say: "The problem before us seems to be the selection of the proper materials for definite uses and the development of a correct procedure in every instance. Welding technique will determine to a very great extent the quality of a weld. Given the same plate and welding rod, one procedure may result in a perfect weld, while another may produce a weld showing incomplete penetration, numerous gas cavities, and other defects. Experience indicates that when the proper technique has been developed, satisfactory welds can be obtained with reasonably good material provided one quality of plate and one quality of welding rod are used. Therefore, perhaps a modified procedure should be followed for each set of conditions. Carrying this thought to its logical conclusion, it is obvious that as few combinations as possible, in the way of base metal and rod, be employed."

A. M. Candy, Welding Engineer of the Westinghouse Electric & Manufacturing Company, speaking on "Modern Applications of Arc Welding" in yet another A.S.T.M. paper, explains that the designer must clear his mind of prejudices to previous details of designs before he can be successful in adapting welded construction. He must consider a given problem from a fundamental standpoint to be certain that he will develop the most simple structure that will fulfill the requirements. His design must involve as few individual pieces as possible so as to reduce the amount of welding to a minimum. He must strike an economic balance between the cost of structural shapes and plate at 2 to 3 cents a pound and weld metal in place at $1.50 to $3 a pound. In other words, the designer must not merely attempt to replace a former riveted or cast structure with another similar one of welded construction; he must redesign it completely in order to obtain desired economy.

■

Special Training for Mass Production

The Citroen Company, the large builder of small automobiles in Paris, has introduced special training for its apprentices in addition to the regular training in various phases of machine shop work. The company feels that the modern subdivision of work and the use of special machinery require a new type of training, and has equipped a special shop with over 20,000 sq.ft. of floor space and 92 machine tools for this purpose. This shop includes raw material stores, a tool shop and a planning office where apprentices get experience in shop management. About 100 boys are trained here. The course lasts a year and counts as one year of apprenticeship.

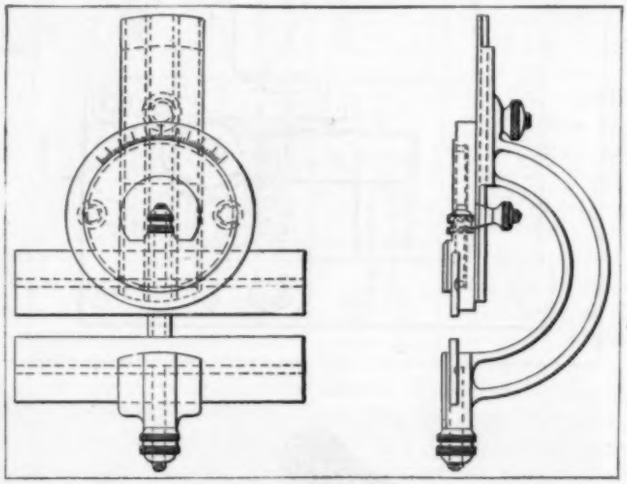
IDEAS FROM PRACTICAL MEN

A Universal Protractor for Tapers

G. H. FELSKE
Foreman, Atlas Car & Manufacturing Company

TO ELIMINATE the guesswork in turning tapers, I made the protractor shown in the illustration. The frame of the tool is U-shaped and has at one end a graduated head mounted on a slide. Two short straight-edges, similar to the scales used in combination squares, are held by clamping screws, one in the graduated head, and the other in the opposite end of the frame. The graduated head can be rotated and the straight-edges can be moved endwise. Both the head and the straight edges can be locked in position by clamping screws.

By setting the graduated head to the desired angle, the straightedge attached to it is brought to that angle, so that the straight-edges form two sides of a taper gage. In use, the tool is slipped over the work as when using a micrometer. For finding chords of arcs, scales from



combination squares can be used in place of the straight-edges. By setting the graduated head to the angle required and sliding it until the scales touch at one end, the chord can be found by measuring the distance between the scales at the radius wanted. Of course, the ends of the scales must be even where they touch, and the measurement must be at right angles to a line midway between the scales. We use this tool constantly in turning taper shanks on boring bars, and in duplicating tapers in making repairs on tools. We have even used it in turning small bevel gears to the proper angles, and in machining taper gibs.

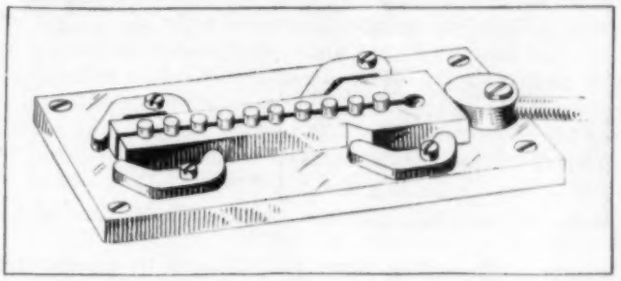
Tapers are always troublesome, partly because of the lack of suitable gages to work with. The tool described will do much to simplify this class of work.

A Quick-Operating Fixture for Slotting Screws

CHARLES H. WILLEY
Superintendent of Manufacturing, Hoyt's Electrical Instrument Works

Having a large quantity of fillister-head screws to slot, a quick-operating fixture was desired. While several of the slotting fixtures that have been described in the *American Machinist* were given consideration, one of our men decided to try out a scheme of his own, which is shown in the illustration herewith.

The fixture consists of a set of four clamping fingers



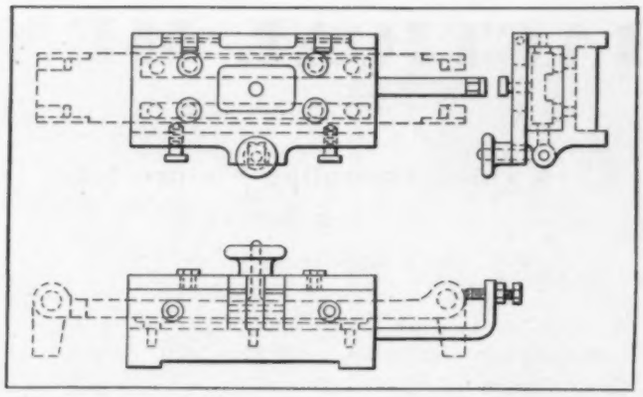
mounted on a base; a split holder for the screws; and an eccentric to force the holder into the clamping fingers, causing them to both grip the holder and to close it tightly on the screws. A study of the illustration will be sufficient to disclose the action of the fixture. The slotting saw revolves in a direction that tends to force the holder against the long ends of the fingers, thus holding it tightly at all times. No trouble was experienced in the holder tending to lift from the base. The screws to be slotted were of brass.

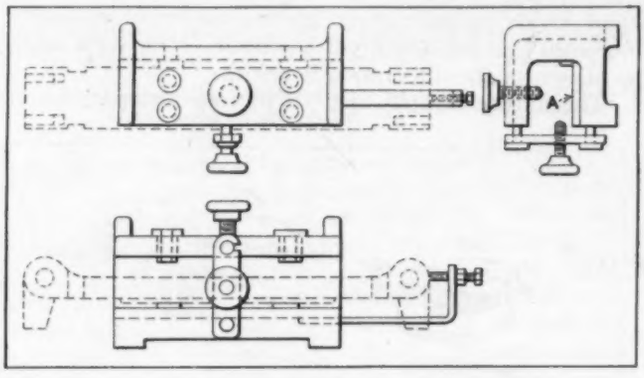
A Latch-Cover Jig Shorter Than the Work
Discussion

EDWARD GREENSPON

In my opinion, the device described by Frank Hardy, on page 936, Vol. 73, of the *American Machinist*, is neither efficient nor desirable except for very limited quantities. Even then, its doubtful saving in the cost of making hardly warrants it. I feel that removable bushing plates should not be used on drill jigs where they can be avoided. In this case, the work being large (supposedly), a stand or other special item must be provided whereon to place the plate while work is being handled into or out of the jig. Unless the clearance between the retaining faces is liberal, it would not be easy to get the plate onto the jig very quickly. When removing it, there is always the risk that the operator's hand may run into the drill through some unexpected jerk or shift.

The latch cover at the rear is also a hazard to the





operator, depending upon how close it is to the drill point at the time of loading or unloading. No great degree of accuracy could be maintained in the location of the holes from the sides of the part, since the part, like the plate, is simply dropped into the channel, therefore requiring plenty of clearance to allow for variation in width and for quick insertion and removal. Also the jig is rather slow in operation, as several movements are required to load and unload it, and there is always the risk, if lubricant is used, that the plate may slip out of the operator's hand and drop on his foot. The jig could be greatly improved by arranging the cover so as to be hinged at the back, and one or two latch screws provided for clamping the lid down in front.

The screws in the top of the cover for holding the work down would be retained, and one or two more added in front of the jig to locate one edge of the part firmly against a pair of rest buttons in the rear face, the same as are used to rest the work upon. The jig could then be widened considerably to permit easy insertion and removal of the work. The center of the cover could be cored, or cut out for lightness, or the plate could be dispensed with, and a pair of rectangular pieces of steel, slotted, drilled, reamed, and tapped for hinge pins, drill bushings, and clamp screws, used in its place. In Fig. 1 all these changes are shown.

In Fig. 2, is shown a very simple and inexpensive jig for the job in question. It is safer and much quicker to operate than either the one shown in Fig. 1, or the one described by Mr. Hardy. It is a single-piece casting, though it can be built up if desired. The front is open and is made wide enough to permit the part to be swung in or out easily. The drill bushings extend through the top a short distance to provide support for the drill, but they do not come down far enough to interfere with loading or unloading.

The work is forced against the two rest buttons at the rear by the clamp screw in front. The clamp screw is threaded into the hinged strap, which swings down out of the way when loading or unloading. The single clamp screw in the center of the top of the jig will be found ample for holding the work down. By using large hand-knobs, or small wheels and coarse-pitch screws, they can be operated about as fast as can cams, and the cost is rather less. The buttons upon which the work rests in the jig shown in Fig. 1, are replaced by the wear strips *A*. This type of jig is well suited for mass production under a multi-spindle drill, using an indexing table. Bosses may be added to the top of the jig, and holes bored through them to take guide pins for lining up with a drill head.

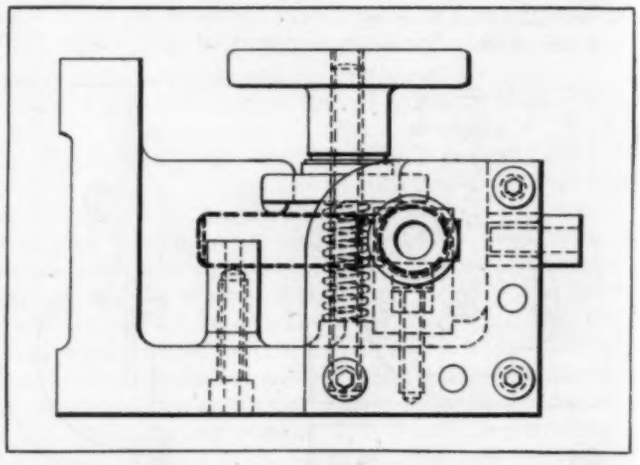
■

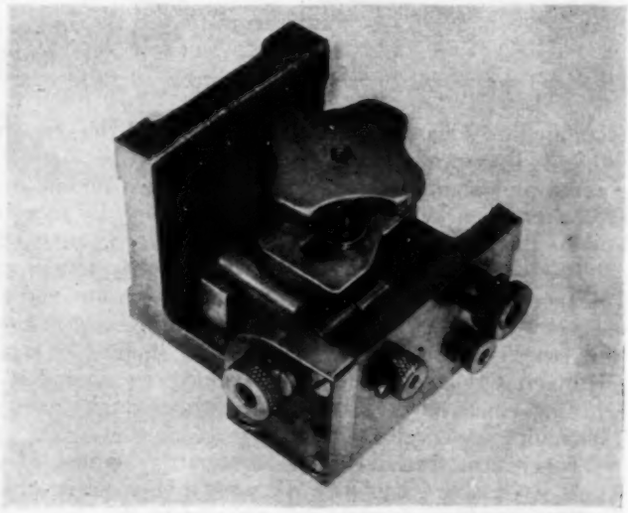
A Simple Box Jig

W. S. Wolfram

Engineering College, University of Michigan

In tooling up a hand grinder, a box jig has been developed which is simplicity itself, yet it embodies advantages usually not found even in jigs of more complicated design. The work is a T-rest bracket having a round finished shank with an unfinished boss at right angles to its axis, through which a $\frac{3}{8}$-in. hole must be drilled and reamed perpendicular to the longitudinal axis,





and a ¼x20 U. S. S. thread hole drilled and tapped in the end boss.

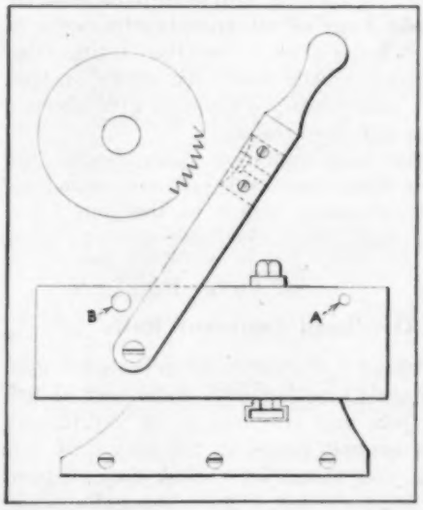
The work is positively located for length by a V-block fitting the end boss, insuring concentricity of the hole and the boss. Perpendicularity is attained by the support plate which is integral with the V-block upon which the work rests, while a second V-block brings it to position. The clamp is a simple equalizing type, one part of the nose bearing on the boss and the other (notched to prevent marring) bearing on the round shaft. The clamp is prevented from turning by sliding in a slot cut in the brace, yet can be slid up and down to lock or unload the work. Ream and tap bushings are stored in the jig body.

■

Fixture for Slotting Special Screws
Discussion

CHARLES KUGLER

Under the title given above, H. L. Wheeler, in an article on page 789, Vol. 73, of the *American Machinist*, describes a device for slotting screws that is both cheap and efficient. Upon reading Mr. Wheeler's article I was reminded of a fixture that I had seen in a shop where I had worked, and which I think is superior to the one described by him, in that it has means for partially ejecting the screws after they have been slotted.



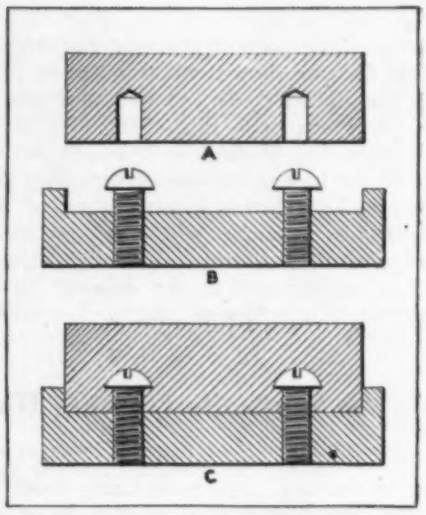
Referring to the illustration, a base mounted on the toolblock of a lathe carries a lever pivoted thereto. A piece bored to receive the screws is secured to one side of the lever. Both this piece and the lever are slotted, so that when the lever is moved to a position approaching the horizontal, the pin *A* will engage the slot and will push the screw far enough out of the holder to be removed by the fingers. The pin *B* acts as a stop to control the depth of the cut. A holding piece is, of course, required for each size of screw to be slotted.

■

Attaching Rubber to Metal

H. D. PALMER

It is known that rubber parts attached to metals by cement of any kind will not always remain tightly affixed, due to changes in temperature. Rubber parts of various shapes and of different degrees of hardness, such as pads, stops and bumpers are sometimes required on machinery, and their attachment by means of countersunk-head screws is often prohibitive, especially where the rubber is to act as a buffer. However, they can be attached by the method here described.



In the illustration is shown a rubber piece and the piece to which it is to be attached. Two $\frac{5}{32}$-in. blind holes are drilled in the rubber, and two $\frac{3}{16}$-in. round-head screws are put into tapped holes in the piece to which the rubber is to be attached, both sets of holes being at the same center distance. If both parts are put in a vise, or a press, in proper alignment, the screw heads can be pressed into the blind holes in the yielding rubber. The screw heads will expand the holes, and the surfaces of the rubber and the metal can be brought tightly together. When the pressure is released, the elasticity of the rubber permits it to contract and close tightly around both the heads and the bodies of the screws, the assembly appearing as at *C*. Thus, the screws make substantial anchors for holding the rubber in place. No cement is necessary.

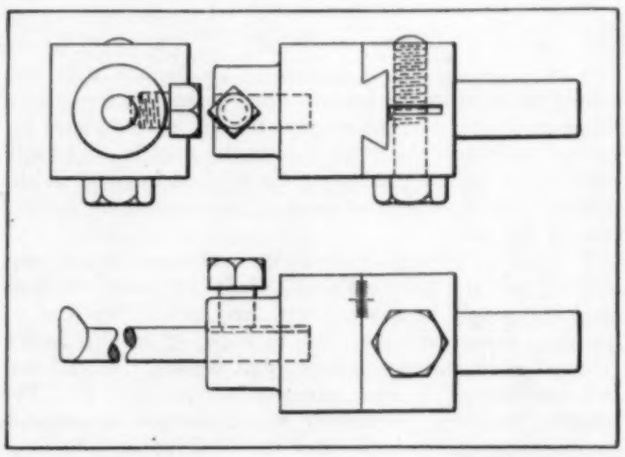
■

An Offset Holder for Boring Tools
Discussion

DON R. HAMMITT

Chief Engineer, Portland Forge & Foundry Company

In an article under the title given above, on page 751, Vol. 73, of the *American Machinist*, A. F. Fontanella describes an adjustable, or offset, holder for a boring tool for use in the milling machine. While Mr. Fonta-



nella's device is both practical and cheap to make, I think that the one shown will stand more punishment.

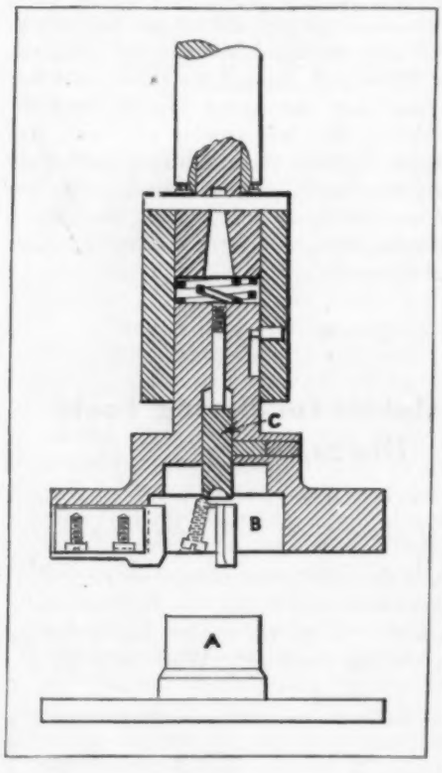
The holder conists of two steel parts dovetailed so as to slide one upon the other. The shank can either be straight for holding in a chuck, or it can be tapered to fit the hole in the machine spindle. The outer member is bored to receive a round-shanked boring tool, which is held by a setscrew. The two members can be clamped together by a screw, the inner member being slotted at a right angle to the dovetail to provide clamping spring. The holder is graduated to set the tool.

■

A Vertically-Floating Hollow Mill

STANLEY PORRITT

In our work, we have many small castings on which there are bosses, such as the one at *A*, to be machined on the outside, the work being done in a drill press by means of the hollow mill *B*, the length of the machined part being measured from the top. Because of the variation in the height of the bosses, we put the stop *C* in the center of the hollow mill so as to stop it from cutting when it reached a point 1 in. from the top of the bosses. It will be seen that with this kind of a stop, the conventional kick-off could not be used.



We then mounted the hollow mill as shown in the illustration, it being permitted to float about ½ in. vertically. A sleeve was placed over the nose of the spindle being driven by a key through the drift-pin hole. The shank of the hollow mill was turned to fit the sleeve and stiff springs were placed above it. A piece of heavy-gage tin was placed above the springs to protect the taper hole in the spindle. The mill was driven by a screw engaging a blind keyway in the shank. The keyway also limited the amount of vertical float of the mill.

A casting having one of the shortest bosses was selected and the hollow mill was fed down over the boss until the stop *C* contacted with the top. The feed of the drill press was then set to kick off at this point. In machining castings having high bosses, the mill was fed down until it was arrested by the stop *C*. The spindle, however, continued its downward movement, compressing the springs, until the feed kicked off.

SEEN AND HEARD

●

Getting Under the Scale

DIRT and hard scale on the surface of castings are bugbears in most shops. Here is one place where T-C cutting tools frequently shine. Tire molds are very apt to be hard, and it's quite a trick to get under the scale on the first cut. If you don't, it's good-bye tool of the usual kind.

A T-C tool on a tire mold rode in and out of the scale and into the chill without any particular damage and then cut the back side of the mold at 250 ft. a minute; *some* speed for a boring mill! As with many other things in machine shop practice, the answer is to pick the right tools and machines for the particular job. There is no greater mistake than trying to use the same equipment for all kinds of work.

Tool Clearance for Duralumin

LITTLE THINGS count a lot in the final cost of getting out a product. In turning Duralumin in a screw machine, for example, some of my friends who ought to know tell me that it helps a lot to set the cutting edge of box and similar tools a little above the center, instead of at the center, as with brass. They also give about 5 deg. front clearance for best results.

Forming tools that pass under, or down beside, the work, which makes them practically shaving tools, act better with a little shearing action to the cut. Ten deg. shear and 10 deg. front clearance gives a good clean job.

Welding Overhead Conveyor Rails

PUTTING up overhead conveyor rails isn't what it used to be. Bolting the ends together with some sort of fish plate was a fussy job, and you had to be careful not to have fish plates or bolt heads in the way. If you riveted the joints it was worse yet. Now they suspend the rails by their hangers, butt the ends together, and weld them with a portable outfit. Any flash that might bother is ground off with a portable electric grinder. If you want to take them down it's a lot easier to cut the rails with a torch than to unbolt them. And there's nothing to get loose. —*J.R.G.*

Obsolescence Forty Years Ago

"THIS obsolescence survey you've been making in *American Machinist* is a hum-dinger," said a machine-shop executive of forty years ago. "Obsolescence is a lot more important than we used to think. We figured 66 to 86% overhead on work we did, and bought a new machine when we couldn't find any more pieces of wire to fix the old one. We even bought machines by the pound. Our rule on repair work was, 'Twice the labor plus the material,'—we didn't figure the machine there either. We used to kinda wonder why we didn't make much some years, and may be that was the reason—we forgot to allow for worn-out or almost worn-out tools until they just naturally fell apart!" —*T*

Materials Handling Analysis

SIX BILLION DOLLARS, almost a tenth of America's income, is the estimated annual loss in the handling and distribution of materials. Economy of operation is a powerful producer of profits. Few are the manufacturing plants which have reduced the handling, of materials to the minimum. As an aid to New England manufacturers, the New England Council, co-operating with materials handling firms, has issued the following series of questions, which may well be applied to American industry generally. Through the courtesy of the Council, AMERICAN MACHINIST *has been permitted to reprint them.*

General:

1. Are we interested in further reducing unnecessary handling?
2. Are we interested in increasing our effective production and storage space and in reducing non-productive time of machinery?
3. Are we interested in reducing fatigue and increasing safety?
4. Are we interested in increasing size of unit of production?
5. Are we interested in reducing inventory and shortening the period of conversion?

Reducing Handling:

6. How many times do we pick up and put down each article we manufacture?
7. Would it be possible to receive and ship our material on skids to reduce handling?
8. Do we pile and unpile each individual item we carry in storage?
9. How many tons of material do we handle for every ton of finished products?
10. Have we planned to route material through our plant with a minimum of rehandling?
11. Have we co-ordinated our handling system with production?
12. Have we made it easy for customers to handle our product when they receive it?
13. Will a materials handling system improve our production control, deliveries, sales, and purchasing?
14. Will a more modern materials handling system make the keeping of accounting and production data easier?
15. Will a proper handling system reduce our costs of moving fuel, ashes, and waste products?
16. Will a materials handling system increase our capacity without an increase in direct labor costs?

Increasing Effective Production and Storage Space:

17. Is too much material tied up in transit, cutting down our production space and increasing inventory of work in process?
18. How rapidly does work in process move between operations?
19. What percentage of our floor space is occupied by banks of work in process?
20. Have we tried to increase our men's efficiency by setting up standards of correct handling and piling?
21. Can we eliminate congestion by using more overhead storage space?

Eliminating Non-Productive Time:

22. Do we deliver material to each worker as fast as he can use it?
23. Do we remove finished material as fast as it is ready?
24. Are the operators of our machines required to lift material to machine height?
25. Do our machine operators stop productive work to do things which a low-cost laborer or mechanical equipment might do better?

Reducing Fatigue:

26. Do we have men piling our material at points where a machine could do the work more efficiently?
27. Is it necessary for our operators to lift heavy raw materials to machines?
28. Are our men carrying material by hand which might better be transported by machine?
29. Have we eliminated hand labor in moving work in process, wherever possible?

Increasing Safety:

30. Do our men do unnecessary work, causing excessive fatigue and accidents?
31. Do we pile the material going through our plant in well-arranged units for safety?
32. Can we use proper piling equipment so that the percentage of injuries due to falling objects will be reduced?

Increasing Size of Units of Production:

33. Can we consolidate our material in process into larger units to reduce the number of necessary handlings?
34. Can we stock material in larger units to provide for quicker handling of raw stock?
35. Can we ship in a larger unit to reduce handling costs at both ends?

Reducing Inventory:

36. What is our proportion of inventory of work in process, to inventory of raw materials, and inventory of finished product?
37. Can we use a materials handling system to move material between operations more quickly and cut down material in process?
38. Have we provided a storage system which allows for quick delivery of material from storage to manufacturing process?

Shortening Conversion Time:

39. Can we cut down the time during which material is in process of manufacture by installing an adequate system of handling?
40. Have we planned our handling system so that the smallest possible amount of time is lost between operations?
41. In the designing of our product, have we considered it with the view of facilitating its handling, thus shortening the time the material is in process?

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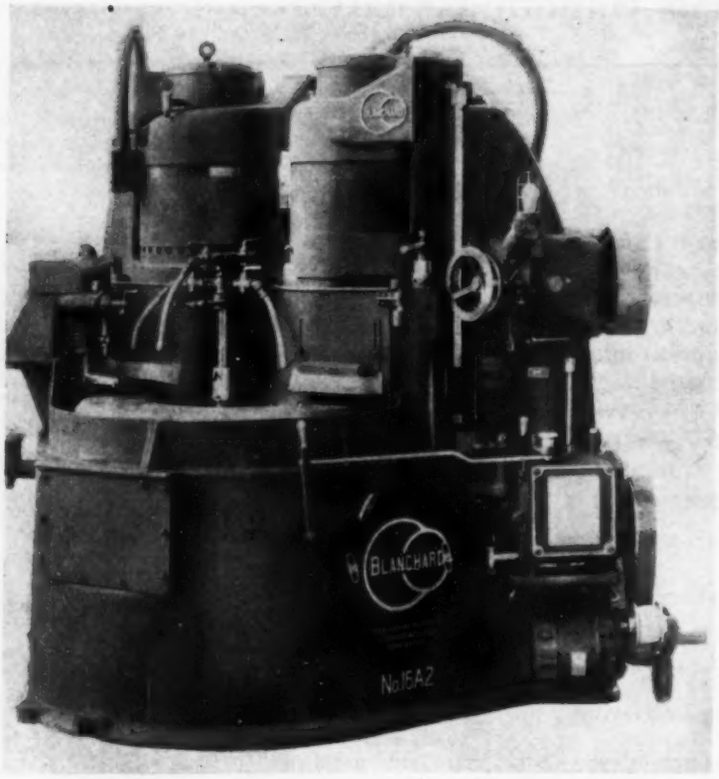
SHOP EQUIPMENT NEWS



Front view of the Blanchard No. 16-A2 Automatic Surface Grinder. Work is rough ground by the wheelhead at the right and finished by the one at the left

Blanchard No. 16-A2 Two-Head Automatic Surface Grinder

EXTENSION of the design principles of the No. 16-A single-head surface grinder to a No. 16-A2 double-head machine has been announced by The Blanchard Machine Company, 64 State St., Cambridge, Mass. The latter unit has been brought out for work requiring high accuracy and finish, or for work requiring more stock removable than is possible with a single wheel. The use of both a roughing wheel and a finishing wheel simplifies wheel selection and reduces wheel cost per unit of work. Separation of roughing and finishing also improves accuracy, because any distortion of the work in the rough grinding is corrected by the finishing wheel.

Each of the two wheels of the No. 16-A2 machine operates in the same manner as the No. 16-A unit, and each wheel is controlled independently by its own wheel-control caliper. Having determined the proper amount of stock to leave for the second wheel, the caliper of the first wheel will control its height so as to leave exactly the amount required, regardless of variations in the initial stock on the rough pieces. The caliper of the second wheel, set for finished size, will control that wheel to deliver a uniform thickness of finished work.

The base is cast in one piece and serves as a coolant tank. On it is mounted a circular casting containing the bearing surfaces for the rotary table or chuck. Two columns, each carrying a wheelhead, are positioned over the working surface of the table, and each is independently adjustable on its three-point support so that the alignment of each spindle can be made independently with reference to the table or chuck. The work-holding surface of the table is 40 in. in outside diameter and 26 in. in inside diameter, and the work to be ground must lie between the 26-in. circle and a 43-in. clearance circle. Close beside each wheelhead and rigidly supported on the base is a wheel-control caliper. Each column carries independent feed mechanism for its wheelhead, with the power feed motion controlled by the caliper. A gearbox giving four speeds for the table, with a clutch for starting and stopping, is mounted on the base and driven by a 2-hp. motor. Two water pumps of vertical submerged centrifugal type, each direct driven by a $\frac{3}{4}$-hp. motor, are mounted in the rear of the base tank and adjacent to the cleanout hopper. Electrical control apparatus for the seven motors on the machine is mounted on a separate panel standing on the floor, and operated by push buttons on the machine.

For work which can be chucked magnetically, a magnetic chuck of the single-pass type is used. The magnets which energize the chuck under the finishing wheel are on a separate circuit, and their holding power can be adjusted by means of a rheostat. For work required to be clamped mechanically, several types of fixtures are available, ranging from automatic to simple hand-clamping types. These fixtures are specially designed for the work, except that the operating mechanism of the automatic clamping fixtures is somewhat standardized to permit using the same operating unit with various jaws and locating points.

Varying amounts of stock on the rough work and variations in hardness of the wheels make it impossible to depend on adjustment to a constant rate of feed to compensate for wheel wear. The method used in the Blanchard automatic grinders is to provide power-driven feed motion that is locked out of action until re-

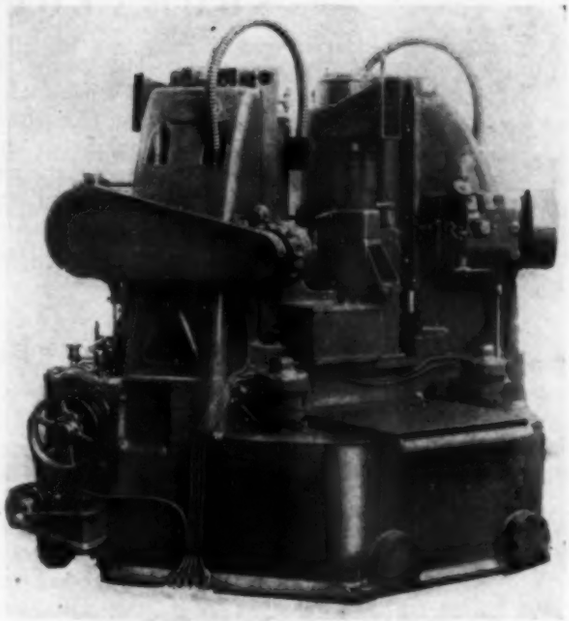
leased by the wheel-control caliper. This device consists of a vertical spindle mounted in ball bearings, and carrying at its lower end an arm. This arm holds a shoe, or contact, member having a lower surface parallel to the surface of the table. At its upper end this spindle carries an arm of insulating material holding a small copper disk. A slight turn of the spindle brings this copper disk against two contacts, thus permitting current to flow to the magnet coil on the feed mechanism. The caliper spindle and its bearings are carried in a sleeve that is adjustable vertically by means of the crank handle on the horizontal shaft. One turn of this crank handle moves the spindle up or down 0.005 in., and graduations to 0.0001 in. make it easy to make small adjustments.

With the caliper shoe and grinding wheel at the same height above the table, a piece of work ground by the wheel will touch the caliper shoe as it passes under it. The work will not move the caliper shoe because the friction will be negligible, but as the wheel wears, the pieces of work will be of gradually increasing thickness. An increase of between 0.0001 and 0.0002 in. will give sufficient pressure against the shoe to move it, causing the caliper spindle to turn in its ball bearings against the resistance of a very light spring. This motion closes the contacts and the magnet lifts the locking pin, which allows the feed pawl to operate. The crank, which drives the pawl, runs continuously, but the slotted connecting rod allows the pawl to be locked in the up position until the caliper releases it. As soon as the grinding wheel has moved down sufficiently to produce work of the thickness required, the caliper spindle turns back to its original position, which opens the contacts. The magnet drops the locking pin, and no further feeding motion occurs until again called for by the caliper. The sensitiveness of the device is such as to operate on very small changes in work thickness, and all pieces of work are within usual working limits of plus or minus 0.001 in. on soft work and 0.0005 in. on hardened work, so that no pieces need go back for regrinding. The rate of wear of the 18x5x10 in. grinding wheels is so slow that the lag in size correction, due to the number of pieces of work between the grinding position and the caliper, is negligible.

Since the feed is locked, except when the work coming to the caliper is slightly too thick, there is no chance of grinding undersize. As the control is governed by the actual gaging of the ground work, it is not affected by varying rates of wheel wear, whether due to inequalities of hardness in the wheel, or variations in the amount of stock on the work coming to the wheel.

Applied to each of two wheels independently, this method of size control makes it possible to control accurately the amount of stock left for the second wheel besides controlling the finished size. This allows the finishing wheel to operate under fixed conditions — constant work speed, wheel speed, and depth of cut.

Over-all dimensions of the machine are 7 ft. 5 in. long by 7 ft. 3 in. wide, and the height is 8 ft. 1 in. Net weight without water in the 238-gal. tank is 17,500 lb. Motor equipment includes: Two 30 hp., or smaller, motors on wheel spindles; a 2-hp. motor to drive the work table; two 2-hp. motors for raising and lowering the wheelheads; and two ¾-hp. motors direct connected to the pumps. The machine is shown with motors for 60-cycle a.c., but 220-volt d.c. motors can be supplied.

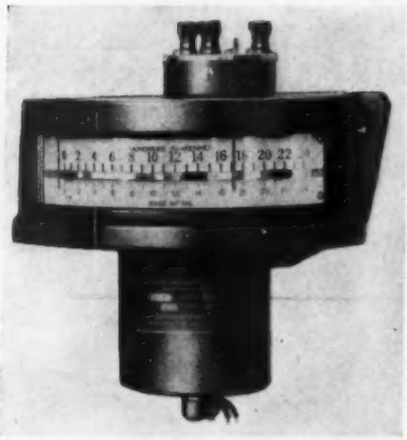


Rear view of the Blanchard No. 16-A2 Automatic Surface Grinder, showing the two water pumps and the cleanout hopper of the tank, which is covered with a floor plate

Front view of the machine, showing an operator grinding steel blocks. This view shows the ample space for loading and unloading. The table moves continuously to the right

"Tycos" Improved Indicating Pyrometer Control

Several improvements and additional features are found in the improved "Tycos" indicating pyrometer control manufactured by the Taylor Instrument Companies, Rochester, N. Y. The weight of the instrument

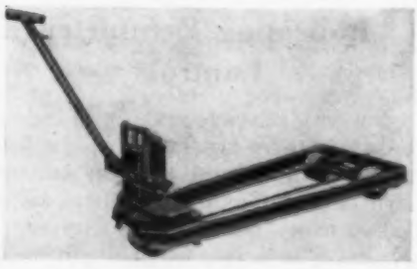


"Tycos" Improved Indicating Pyrometer Control, now easier to install

has been decreased by 3 lb., and it has been found quiet in operation. Elimination of the back panel simplifies wiring and makes the instrument easier to install or take down. Simplicity of design and absence of vibration or shock in the operating mechanism insure dependability and long life.

Lyon Hydraulic Lift Truck

Capacity of the hydraulic lift truck announced by the Lyon Iron Works, Greene, N. Y., is 6,000 lb. Easy lifting is provided by operating the handle with either long or short strokes. No ratchets or pawls are required to be thrown in or out. Thus, the handle can be used for full strokes for quickly raising loads where there is sufficient space or by using short strokes with the handle in the upper position, the load may be raised in congested spaces. To lower the load, the operator grasps the small lever just below the handle, and the load may be stopped at any point by releasing the pressure on the lever. The handle may be turned a full 360 deg., and the operator can also elevate or lower the load from any position. The handle remains in any position.



Wheels of this hydraulic lift truck are furnished with Hyatt bearings, and roller and thrust bearings are used in the steering mechanism. The frame and other parts are arc welded.

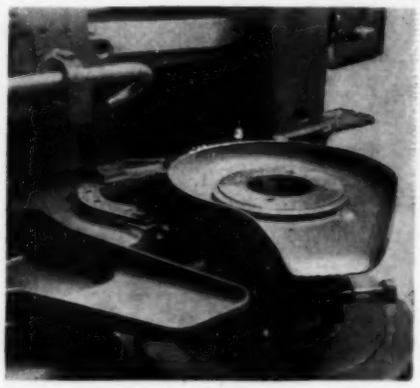
The truck is available in the Model N with a 17-in. wide platform and in the Model W with a 26½-in. wide platform. The lowered heights range from 6 to 7 in., for the first type and from 7 to 11 in., for the second type. Carrying platforms range from 30 to 42 in. for the first type and from 42 to 60 in. for the second type. The vertical lift is 3 in. for all sizes.

Fellows Type 64A Gear Shaper

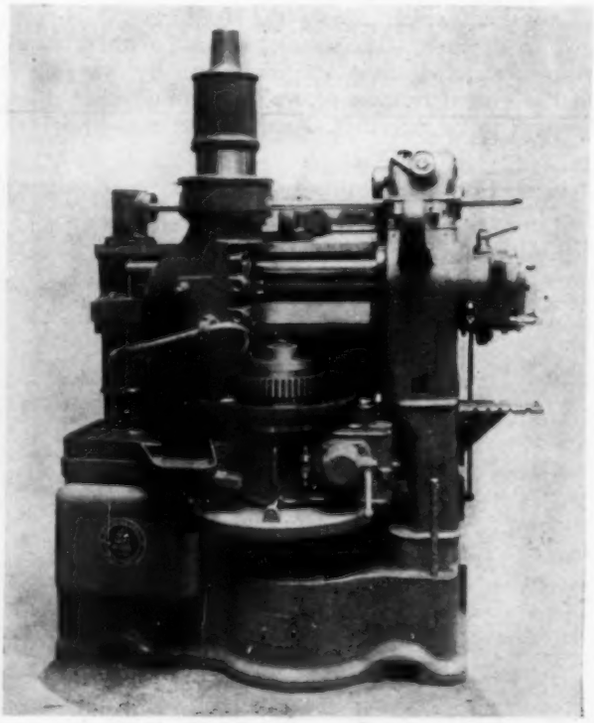
A line of gear shapers, known as the 64A Type, has been placed on the market by the Fellows Gear Shaper Company, Springfield, Vt. This line bears the following designating numbers: 64A, 624A, 624A-3, 645A, and 645A-3. These machines are fundamentally of the same construction as the standard 6A and 6A-3 types, with the exception that a new apron of more massive design to accommodate a large work spindle is used, so that gears integral with the shanks can be cut. The work spindle shown in the close-up has a 5⅞-in. hole passing completely through it. This work spindle can be arranged with sleeves to hold shank gears having a maximum shaft diameter of 5 in., or with an adapter to fit standard reverse-taper work arbors.

Additional features besides the new apron are: A hardened and ground plate on the base for the apron bearing; and grease pressure cup lubrication for the apron, work spindle, apron-bearing angle block, and apron pivots.

Capacities of the Nos. 64A and 624A types are: 18-in. external and internal spur gears, 5-in. face external, 3-in. face internal. The 64A is adapted to the use of both 3- and 4-in. pitch diameter cutters with a 1¼-in. hole; whereas the 624A-3 can only use cutters with a 1¾-in. hole. Capacities of the No. 645A are the same as the Nos. 64A and 624A, with the exception that this machine is adapted to the cutting of helical and herringbone gears, in addition to spur gears. Helical cutters used on this machine are 3½-in. pitch diameter,



Shank gears can be held with sleeves in the spindle



Front view of Fellows 64A Type Gear Shaper with 5-in. stroke

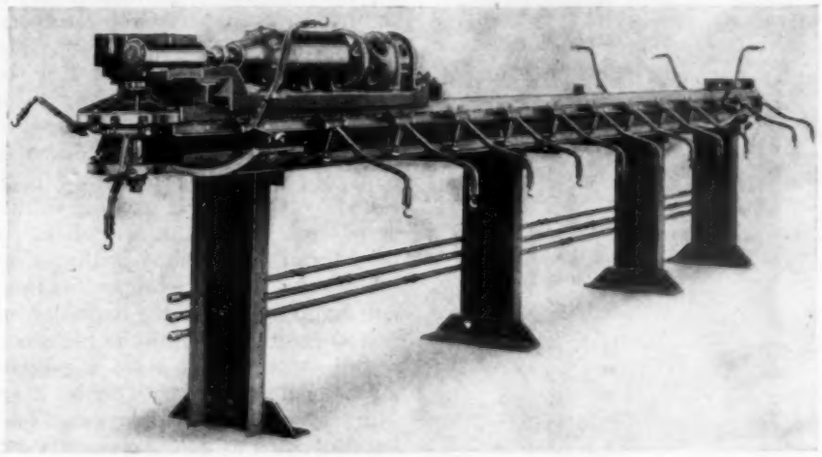
1¼-in. hole, and spur cutters 4-in. pitch diameter with 1¼-in .hole.

The Nos. 624A-3 and 645A-3 have the same capacities as the other machines as far as diameter is concerned, but are limited to the cutting of gears having a maximum face width of 3 in. The 624A-3 is adapted to the cutting of spur gears only; whereas the 645A-3 will cut spur, helical, and herringbone gears. Maximum pitch for spur gears is ¾ D.P., and 5/7 D.P. for helical gears. The 64A types with the 3-in. maximum face width capacity are recommended for heavy-duty production work, as they are supplied with a one-piece cutter-spindle and a rigid saddle.

Stevens Universal, Return-Type Automatic Plating Machine

A universal machine for all types of plating has been announced by Frederic B. Stevens, Inc., Detroit, Mich., in the form of a return-type full automatic unit. Any electrolytic plating or treatment process can be carried out in this machine.

All of the moving parts on the self-contained automatic plating machine—conveyor chain, transfer units, carrier arms and the driving unit—are supported by a structural steel support member. The conveyor chain travels in a horizontal plane and to it are attached rigidly the carrier brackets, to which are hinged brass contact brackets with solid copper carrier arms for supporting the work. These carrier arm brackets are interchangeable and may be spaced at 12, 18 and 24 in. on the conveyor chain to suit various sizes of racks. The raising and lowering transfer units are attached to the steel channels, running the length of the machine. As the carrier arm travels around the machine and reaches one of these transfer units, it is raised up and lifts the work out of one tank and lowers it into the next tank. As the work is lowered into the plating tank, or any tank where electrical current is required, a contact is made between the contact bracket of the carrier arm and the busbar.

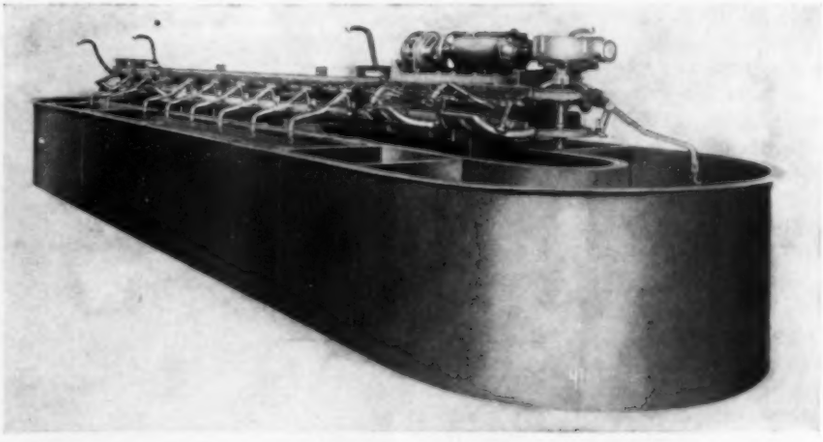


Complete mechanism of Stevens Universal, Return-Type Automatic Plating Machine, comprising the conveyor chain, transfer units, carrier arms, and driving unit

To plate irregularly shaped pieces properly with chromium, and especially those with depressions, special anodes must be used to throw the metal into these depressions and obtain proper deposit. In these machines the carrier arms are equipped with both anodic and cathodic contacts, so that both the specially designed anodes and the work are carried on the same carrier arm.

Ventilation for all tanks is provided, especially necessary when chromium and hot cyanide solutions are employed. A moisture chamber covers the racks during the transfer point. It is practically airtight, and prevents oxidation of material before entering the plating solutions. This moisture chamber is supplied with a shower spray. All tanks that have an alkali solution or hot water tanks can be supplied with header-type steam coils.

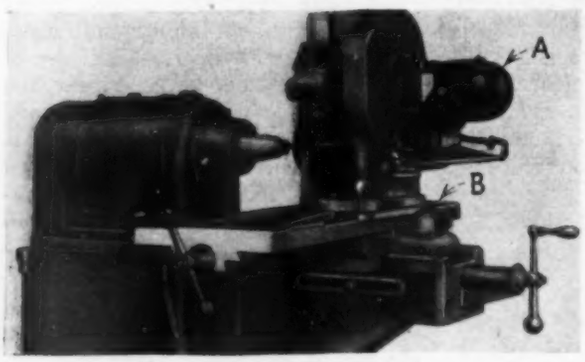
Tanks are made of ¼-in. steel with all joints double welded, and they are reinforced on the sides with angle iron. Tanks containing an acid solution may be either rubber or lead-lined. Machines up to 40-ft. long are shipped as a unit.



Solution tanks grouped around the Stevens Automatic Plating Machine, which is ready for operation after water, steam, and electrical connections are fitted

"Peerless" Model 3 Chamfering Machine with Improved Drive

The workhead of the Model 3 "Peerless" chamfering machine, built by the City Machine & Tool Works, East Third at June Sts., Dayton, Ohio, is now operated independently



"Peerless" Model 3 Chamfering Machine, which now employs a Master geared-head reduction motor at *A* and a quick traverse for the work table at *B*

by a Master geared-head reduction motor. This eliminates all gearing and the universal shafts formerly used in transmitting power from the machine motor in the base. The installation provides more flexible operation and permits a more adaptable method of changing speeds.

A quick traverse to the work table, a feature which is optional equipment, is also available on the improved machine. This feature provides a means for reducing loading and unloading time, particularly on the chamfering of internal gears.

Gleason No. 12 Generator Tool Sharpener

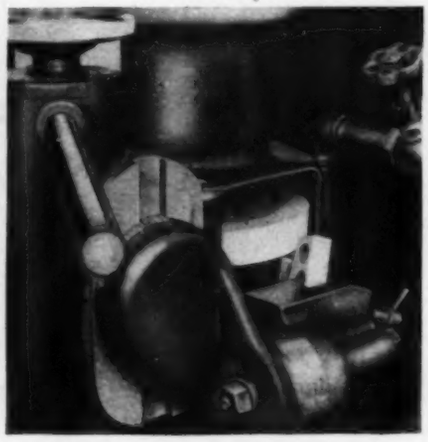
The tools used on any of the Gleason straight bevel gear generators and the 60-in. spiral bevel gear planing generator can be sharpened on the No. 12 generator tool sharpener, announced by the Gleason Works, 1000 University Ave., Rochester, N. Y. This machine is equipped with a pump for delivering ample coolant to the point of contact between the work and the grinding wheel. Only one grinding wheel is used to sharpen both of the tools for cutting the opposite sides of the gear teeth.

The tools are mounted in pivoted toolholders, and moved across the wheel by hand. Feed is obtained by a handwheel on the top of the bracket on which the toolholders are mounted. Grinding is always towards the cutting edge of the tools. The wheel used is a standard 7x2x1¼-in. cup wheel. It is mounted on a spindle which runs on precision ball bearings.

Tools can be ground to any side rake angle by loosening a nut on the toolholder and turning to the desired angle, as marked on the collar. The desired rake angle can be obtained by a similar setting at the point where the toolholder is attached. Three pairs of tool holders can be used, but only one pair is furnished as standard equipment. One pair serves for the tools for the 60-in. spiral bevel gear planing generator, one for the tools used on the 25-in. bevel gear generator and the third for the tools used on the 8-in. manufacturing bevel gear generator, the 3 and 12 in. bevel gear generators, and the old style 6, 11 and 18-in. bevel gear generators.

The wheel spindle is driven by a 1-hp., 1,500 to 1,800 r.p.m. constant-speed motor which is mounted in the base and connected to the spindle by belt. A magnetic reversing switch, which fits in the base, is furnished as standard equipment. Floor space is 32x36 in., and the net weight is 1,500 lb.

Gleason No. 12 Generator Tool Sharpener for the tools used on Gleason gear generators



Tool and wheel of Gleason No. 12 Generator Tool Sharpener

Grob Model B-1 Continuous Filing Machine

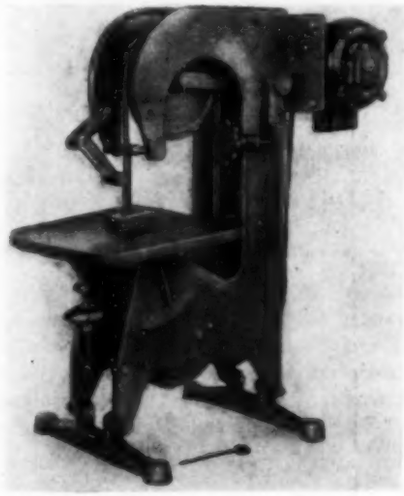
A bench-type, continuous-band filing machine has been added to the line manufactured by Grob Brothers, 90th & National Avenues, West Allis, Wis. This type is designated as the Model B-1, and is designed for either external or internal filing of small and medium-sized work that requires fitting or forming. It is suited to tool and die making, in that deep, flat surfaces up to 4 in. in height can be finished within close tolerances. The features include: automatic tension to the main driving belt; a positive drive to the file chain; a full-support back rest; a positive adjustment to the work table; three filing speeds; and employment of a band of files to give continuous cutting action.

The continuous chain is made up of a series of files that are joined together by links so that they operate on two sheaves. The motor is mounted at the rear and drives the main drive pulley by a V-belt. Drive from the main pulley to the lower sheave is also by V-belt. Automatic tension on the main drive belt is accomplished by mounting the main drive pulley on a hinged bracket. As the filing pressure is increased, the tension on the belt likewise increases and thus aids in obtaining a constant, smooth drive.

In addition to the V-belt drive, a series of driving pins, located within the groove of the lower sheave, offer a positive drive to the chain and prevent slippage in the event excessive pressure is applied. The drive pins are provided with a floating action, so

that they can seat and adjust themselves properly against the back edges of the links and yet offer a positive drive.

A channeled link is securely welded to the back of each file, which not only provides a means of connecting the files together, but also offers a positive alignment with the back rest. The back rest is grooved to receive



Grob Model B-1 Bench-Type Continuous Filing Machine for work up to 4 in. high

this link, and is so made that it offers adequate support directly against the back faces of the files. The channeled links are connected with a series of straight links by pins and flat springs, so that they form an endless chain. This chain is of the self-locking type, but can be disengaged easily when it is to be used for internal filing. Filing chains can be furnished either flat, half round, or diamond shape.

Tension on the filing chain is adjusted by a handwheel at the right side of the machine. It connects with a bracket that moves the upper sheave up or down as desired. An adjustable rubber-covered roller keeps the chain of files firmly against the back rest. The work table can be adjusted 25 deg. either forward or backward. A graduated plate and pointer are used for the purpose of setting the table to the desired angle, whereas positive adjustment is made by a small handwheel located at the under side of the table.

The filing machine is 29 in. high and occupies a space of 15x15 in. The table is 13 in. above the bench and has a working surface of 12x14 in. The machine weighs 150 lb.

Toledo Improved Heavy-Duty Presses

A series of heavy-duty presses has been placed on the market by The Toledo Machine & Tool Company, Toledo, Ohio, for many kinds of heavy bottoming work; such as restriking brake drums; sizing fishplates, emergency brake levers, connections and similar work, thereby eliminating straddle milling operations; embossing articles of rather large dimensions; and for both cold and hot forging operations.

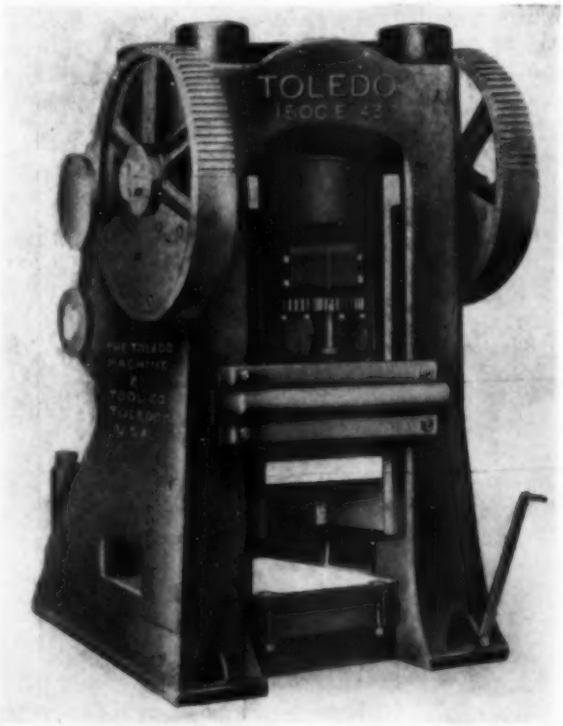
Four-piece, steel tie-rod construction is employed for the frames of these presses with certain modifications in the way of increased proportions. The compactness of the design will be noted from the accompanying illustration, as well as the fact that the base, the two uprights, the crown, and the forged steel tie-rods are unusually heavy. The tie-rods at the back of the frame help take the reaction of the blow, and the heavy knockout bar near the center of the frame still further increases the rigidity. The bed measures 60 in. front to back by 43 in. right to left. Distance from the floor to the top of the bed is 18 in., and although the press weighs about 250,000 lb., the height of the press from the floor is only 14½ ft., a large part of the bed being below the floor line.

The crankshaft is of the full eccentric type and is made of heat-treated special steel. It has a 12-in. stroke and is capable of exerting a pressure of 1,500 tons at the bottom of the stroke. Twin gears are used to give better balance, and these gears are steel castings cut from the solid. The connection screw is proportionately heavy and may be rotated easily to give an adjustment of 3 in.

The slide is provided with extra long ways with a heavy tie across the top. The area of the slide is 36 in. front to back by 30 in. right to left. Distance from the top of the bed to the slide, stroke down, adjustment up, is 24 in. The gibs are square and are of considerable length, and very heavy in design. A hole through the tie for adjusting the screw is provided, and provision has also been made for adjusting the gibs.

Special bronze bearings are used throughout the machine, except for the drive shaft, which has roller bearings. The press operates at 30 strokes per min. The design is such that feeds of all kinds can be attached, so that the available number of strokes that can be utilized is considerable.

The press is equipped with a special watershed lubricating system, which consists of an oil pump for pumping oil to the bearings. Excess oil sheds back to the reservoir. The gears run in an oil bath. The press is operated by a 50 hp. motor running at 1,200 r.p.m. It is controlled by a multiple-disk friction clutch integral with the flywheel, which is mounted on roller bearings and has an independent brake.



Unusually heavy proportions feature the Toledo Improved Heavy-Duty Presses for bottoming work

Reeves Inclosed Variable-Speed Transmission

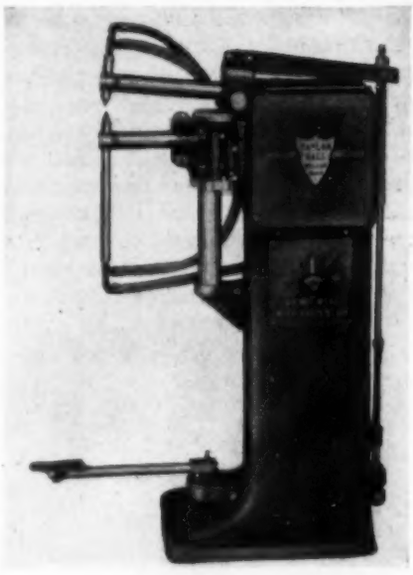
Standard internal operating parts of the Reeves transmission are totally inclosed in a compact, attractive, and symmetrical cast-iron housing, as announced by the Reeves Pulley Company, Columbus, Ind. This inclosure affords complete protection in all machine applications where the operating parts of the transmission must be guarded from water, live steam, chemical fumes, or abrasives. Easy access to the interior is provided by U-shaped recesses in the sides of the bottom section, and permit the removal, as a unit, of the operating parts, including the bearings of the two shafts, as well as the shifting and belt-tightening screws. Removal of the lid from the cover section permits minor adjustments, inspection of the internal operating parts, or installation of a new V-belt.

An outstanding feature of the Reeves inclosed transmission is the improvement in lubrication facilities. Complete lubrication of all bearings is accomplished through forced-feed fittings located in two recessed panels at one end of the transmission. From these eight fittings rigid copper tubes lead to the four radial shaft bearings, and flexible copper tubes lead to the four thrust bearings fitting around the disk hubs. By means of openings from the thrust bearings, the lubricant is also forced into the spiral grooves of the disk-hub bores, thus lubricating the disk hubs, shafts, and driving keys. Each transmission is shipped with all bearings and connecting tubes packed with lubricant. Lubrication is necessary only once in every 30 to 45 days, depending upon the type of service.

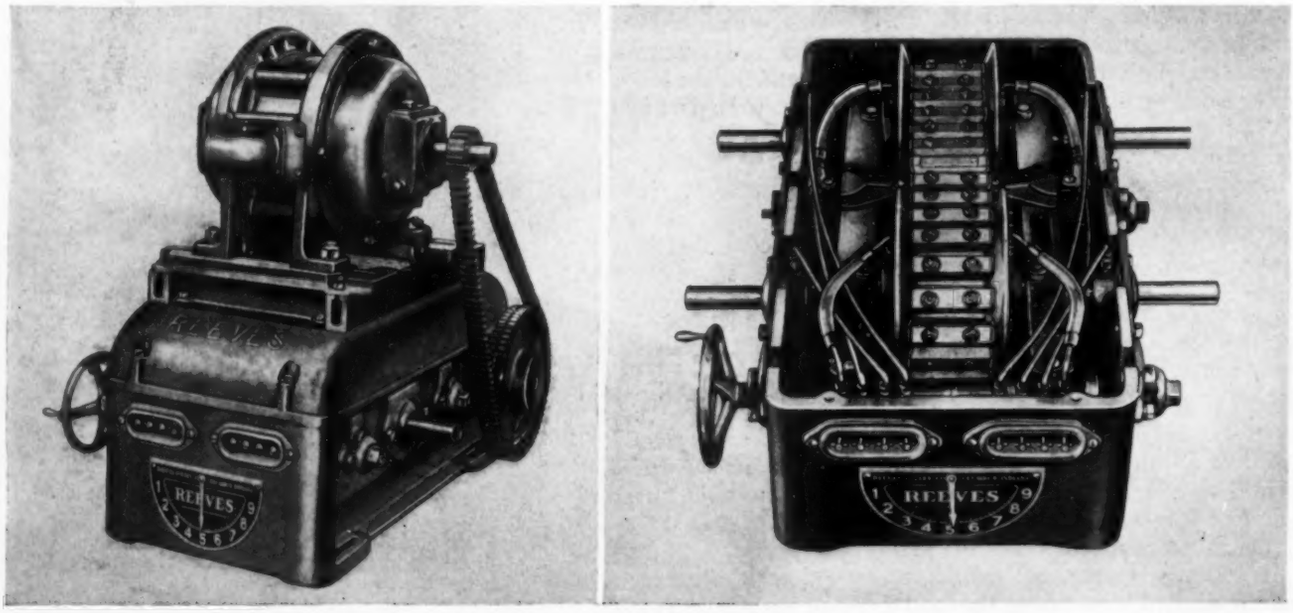
The inclosed Reeves transmission is built in six sizes, covering from fractional to 10 hp. requirements in all speed ranges. It can be mounted on the floor, ceiling, or in the vertical position. The cover section accommodates adjustable motor rails and cross-rails, on which a complete motor unit or auxiliary countershaft unit may be mounted for varying requirements of machine-speed control. These rails are bolted to each side of the transmission cover, outside the space occupied by the lid of the cover section, leaving the lid entirely accessible for removal. The cross-rails, on which the motor is mounted, are also slotted for adjustment.

Taylor-Hall Spot Welders

Spot welders in four sizes have been announced by the Taylor-Hall Welding Corporation, Worcester, Mass. These sizes are the 7½-kw. machine with straight horns, the 7½-kw. machine with adjustable swinging horns, and 12-kw. machines in either type.



On these spot welders, the distance between the upper and lower horns may be adjusted to a minimum of 2¾ in. This results in longer die wear and maximum transformer efficiency. Hard-rolled copper is used for the horns, dies, and lower horn swivel posts. The lower horn has a vertical adjustment of 10 in. and may be used as a swinging arm when welding deep boxes. Die clamps are made of steel to insure long service, and they are quickly removed to allow easy changing of dies. The horn clamping blocks are made in two separate pieces. This insures free and



Left—Inclosed Reeves Variable-Speed Transmission, equipped with a motor base and driving motor. Right—Top cover of unit removed to show the force-feed lubrication system

easy adjustment of horns as well as positive clamping. The treadle may be adjusted in or out and to either side. Both the automatic switch and current regulator are inclosed.

For all sizes, the length of horns is optional from 8 to 24 in. The welding range for the first size is two pieces of flat steel $\frac{1}{16}$ in. thick and for the last size two pieces $\frac{1}{8}$ in. thick. The over-all dimensions are 36x18 in. by 50-in. high, in all cases. Net weights range from 575 to 665 lb. Solid or water-cooled dies and horns are optional.

Speedway Type 450 Pipe Threading Machine

Power is furnished to the Type 450 pipe threader, announced by the Speedway Manufacturing Company, Cicero, Ill., by means of a heavy-duty $\frac{3}{4}$-in. electric drill. The drill can be taken readily from the machine by unscrewing two thumb screws. The Jacobs chuck on the drill grips a steel shank protruding from a universal joint.

The Type 450 pipe threader weighs 65 lb. complete—24 lb. for the drill and 61 lb. for the balance of the machine, but it is sufficiently powerful to thread up to 4-in. pipe. It uses any standard stock and die. In operation, the wings shown on the interior of the circular portion of the pipe threader turn slowly until they connect with nipple-length handles on the die stock. The wings then catch the handles and continue to turn the stock until the power is shut off. Control is provided by means of the switch located in the handle of the drill.

Edmunnds Flexible Couplings

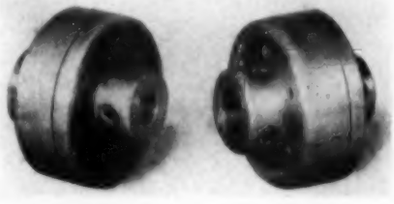
Torsional resilience is provided in the Edmunnds flexible coupling, announced by the Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., by using rubber balls. The coupling also takes care of various forms of misalignment and shock. As shown in the illustration of the disassembled coupling, the flange half has six cylindrical pockets, all parallel to the shaft, and a circular groove in the spaces between the pockets. The other half, the spider, has six projecting lugs between which are placed the rubber balls that absorb the shock. When the two half couplings are in place, the balls occupy the pockets in the flange and, as the torque to be transmitted varies, the lugs on the spider half squeeze the balls correspondingly, and these provide the resilience needed for shock absorption. With this arrangement all the balls are under compression in either direction of rotation.

The balls may be removed for examination or renewal by first taking off the cover over the holes in the spider half, and then pushing out the balls by means of a rod passed through the small holes in the flange half. This makes possible the removal of balls without disturbing the machine or either half coupling. Wear and tear can be localized in the balls, and thus increased life and reduced maintenance charges are obtained. An additional feature is that by removing the rubber balls, the motor or other driving mechanism can be disconnected from the load. This is often useful for testing purposes.

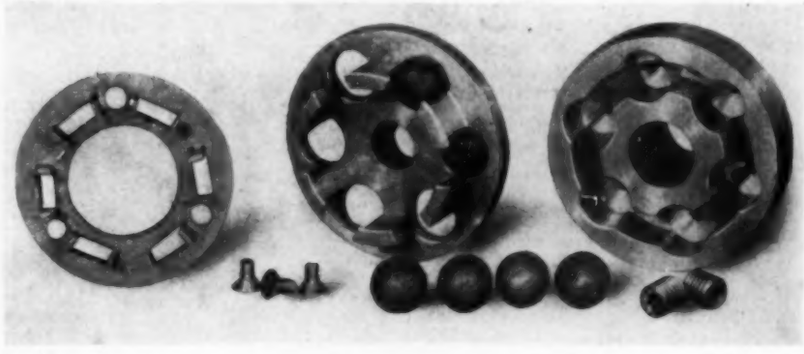
The Edmunnds flexible coupling is made in a range of shaft sizes from the No. 4 with a $\frac{1}{2}$-in. bore to the No. 31 with a $3\frac{7}{8}$-in. bore. The first will transmit $\frac{1}{8}$ hp. per 100 r.p.m., and the second, 35 hp. per 100 r.p.m. It is possible to have a larger bore in the flange half that has the cylindrical pockets.

Lincoln "Stainweld A" Electrode

An extruded electrode, known as "Stainweld A," has been placed on the market by the Lincoln Electric Company, Coit Rd., and Kirby Ave.,



Views of Edmunnds Flexible Coupling, showing the removable cover



Disassembled view of Edmunnds Flexible Coupling, which employs rubber balls as the shock absorbing component

Cleveland, Ohio. It is used with the usual polarity of welding current reversed. The coating of this electrode contains no carbon, thus avoiding the absorption of carbon in the weld metal. As a result, the carbon content of the weld metal deposited will be equal to or less than the carbon content of the stainless steel being welded. This has an important bearing upon the resistant qualities of the weld, since a slight increase in carbon in the weld permits more rapid corrosion. Welds deposited by this electrode are produced in a "shielded arc."

High tensile strength, ductility and resistance to corrosion are produced with the "Stainweld A" electrode. A tensile strength of 96,000 lb. per sq. in. has been produced. Aqua regia has little effect upon the welded metal and less than on the plate metal. The ductility is sufficient to permit a 180 deg. bend.

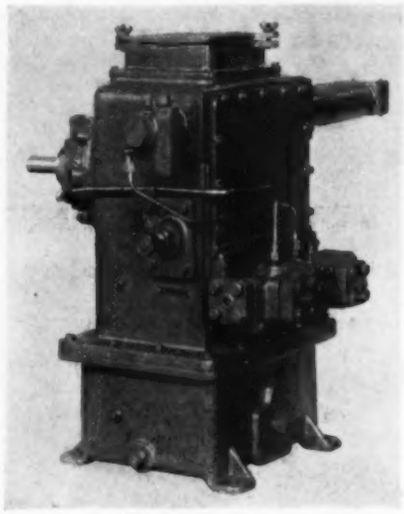
"Stainweld A" electrodes are manufactured in 3/32-, $\frac{1}{8}$-, 5/32-, 3/16-, and $\frac{1}{4}$-in. sizes in the regular 11-in. lengths.

Oilgear Type WES Constant-Pressure Pumps

Three styles of the Type WES constant-pressure pump are being manufactured by The Oilgear Company, 647-683 Park St., Milwaukee, Wis. These styles are the Type WES-5, the Type WES-6, and the special Type WES-6.

The Type WES-5 pump has a maximum displacement of 3,600 cu. in. of oil per min. when operated at a constant speed of 860 r.p.m. This pump can be used on applications where any pressure up to and including 1,000 lb. per sq. in. is required for intermittent or continuous operation, without loss of power or excessive heating of the oil. A peak pressure of 1,500 lb. per sq. in. is available for short intermittent operation.

The Type WES-6 pump has a maximum displacement of 3,400 cu. in. of oil per min. when operated at a constant speed of 600 r.p.m. This pump can be used on applications where any pressure up to and including 1,000 lb. per sq. in. is required for intermittent or continuous operation. A peak pressure of



Oilgear Type WES Constant-Pressure Pump, equipped with a standard small oil pot, which is used for mounting the unit

1,500 lb. per sq.in. is available for short intermittent operation.

The special Type WES-6 pump has a maximum displacement of 4,800 cu. in. of oil per min. when operated at a constant speed of 860 r.p.m. This pump can be used on applications where any pressure up to and including 1,000 lb. per sq. in. is required, for intermittent or continuous operation. The maximum pressure available with this unit is 1,000 lb. per sq. in.

The pumps described are equipped with automatic, constant-pressure type controls, whereby the maximum pressure can be maintained indefinitely without overheating, loss of power, or attention by the operator. The pressure can be released instantly by simply bypassing the oil. A peak pressure relief valve installed inside of the pump casing protects the work, machine, and pump against overloads. An oil reservoir is flanged to the pump casing and is also equipped with a suitable lug for mounting the pump. Any constant-speed source of power can be used for the pump drive. The highly finished working parts are all lubricated under pressure, while all thrusts are carried on ball and roller bearings. A small auxiliary gear pump built into the drive shaft end casing supercharges the high pressure unit at all times. The top cover acts as an oil strainer and also as a breather. Flanged pipe connections insure against leakage at high pressure. The high-pressure pump unit makes 4,300 piston strokes per min., which insures a smooth, powerful and constant volume of oil at any pressure up to the maximum setting of the pump unit.

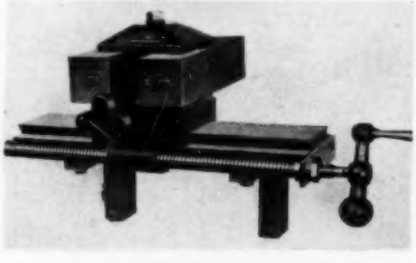
The power required for these pumps is in direct proportion to the work to be performed. Maximum requirements are 15 hp. A $7\frac{1}{2}$- or 10-hp. motor is sufficiently large for most installations. The capacity of the oil reservoir is $4\frac{1}{2}$ gal., and the net weight of the pump is 600 lb.

The accompanying illustration shows the Type WES pump equipped with a standard small oil pot, which is also used for mounting the unit. This pump has the same external appearance as the Type WEA pump, which has been manufactured for several years, but the later model is equipped with an improved high-pressure, variable-delivery pump unit.

Applications of the Type WES pumps are: Horizontal and vertical honing machines, presses, die-casting machines, large furnace doors, pushers, and similar uses.

"Ideal" Commutator and Slip-Ring Grinders

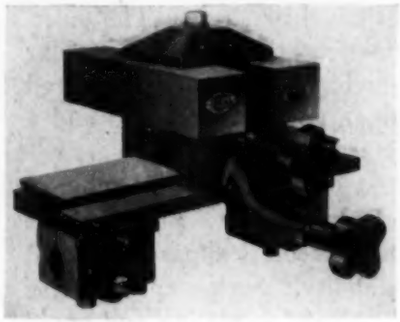
Improvements have been made in the commutator and slip-ring precision grinders built by the Ideal Commutator Dresser Company, Sycamore, Ill. In the "Perfect" model grinder, the screw is now located in the back of the bed plate, rather than in the center, to reduce the chances of binding from grindings being thrown upon it. The head now rides on a solid plate, rather than rails, which makes possible more precise adjustment. Stone tools are now held by one plate, which



"Perfect" Model Grinder of improved design for commutator refinishing

assures a more rigid grip than by means of two clamps. The cross-feed handle of the lathe style has been found more satisfactory to operate than the wheel type.

The "Ideal" model grinder has



"Ideal" Model Grinder of improved design for grinding slip-rings

also been changed. The rack gear has been reversed for the same reason that the position of the screw was changed on the other model; to lessen the chance of binding. In place of the wheel or lathe type handle, a star knob handle has been substituted.

PATENTS

MARCH 17, 1931

Metal-Working Machinery

Welding Machine. Herbert S. Powell, Utica, N. Y. Patent No. 1,796,345.

Automatic Tapping Head. Sydney C. Watson, Chicago, Ill., assigned to The Bradford Machine Tool Co. Patent No. 1,796,352.

Coping Machine. William R. Beatty, Hammond, Ind. Patent No. 1,796,356.

Automatic Feed for Punch Presses. Joseph Wittek, Chicago, Ill. Patent No. 1,796,417.

Method of and Machine for Producing Gears. Magnus H. Johanson, Rochester, N. Y., assigned to Gleason Works. Patent No. 1,796,462.

Method and Machine for Finishing Gears. Alton P. Slade, Rochester, N. Y., assigned to Gleason Works. Patent No. 1,796,484.

Machine for Producing Spiral Bevel Gears. Ernest L. Fickett, Fitchburg, Mass., assigned to Scurlock Gear Corporation. Patent No. 1,796,515.

Metal-Working Machine. Harry W. Rupple, Cleveland, Ohio, assigned to The Cleveland Automatic Machine Co. Patent No. 1,796,538.

Milling Machine. John L. Osgood, Buffalo, N. Y. Patent No. 1,796,663.

Apparatus for Making Nuts. Samuel W. Avis, Greenwich, Conn., and Malcolm H. Ames, Port Chester, N. Y., assigned to Russell, Burdsall & Ward Bolt & Nut Co. Patent No. 1,796,681.

Metal-Drawing Press. Meredith R. Hatch, Toledo, Ohio, assigned to The Toledo Machine & Tool Co. Patent No. 1,796,786.

Automatic Chucking Machine. Arthur J. Lewis, Stratford, Conn., assigned to The Baird Machine Co. Patent No. 1,796,797.

Shears. Ulrich F. L. Steindorff and Herbert J. Heller, New York. Patent No. 1,796,812.

Adjustable Connection for Power Presses. Henry John Hinde, Toledo, Ohio, assigned to The Toledo Machine & Tool Co. Patent No. 1,796,844.

Spot-Welding Apparatus. Thomas M. Hunter, East Orange, N. J., assigned to American Transformer Co. Patent No. 1,796,892.

Slip Compensator for Hydraulic Drives. Walter Ferris, Milwaukee, Wis., assigned to The Oilgear Co. Patent No. 1,796,986.

Apparatus for Opening the Bores of Drill Steels. Gustav C. Pearson, Denver, Colo., assigned to Gardner-Denver Co. Patent No. 1,797,018.

Apparatus for Casting Metal. Carl E. Becker, Camden, N. J. Patent No. 1,797,041.

Wire or Rod Polisher. George Franklyn Matteson, Rockyhill, Conn., assigned to The F. B. Shuster Co. Patent No. 1,797,174.

Carriage Feed Mechanism. Ernest J. Svenson, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent No. 1,797,216.

Tools and Attachments

Screw-Thread-Cutting Device. William C. Johnson, Milwaukee, Wis. Patent No. 1,796,333.

Tool-Centering Pilot. Peter M. Schlauch, Detroit, Mich. Patent No. 1,796,404.

Indicator. John J. N. Van Hamersveld, Cleveland Heights, Ohio, assigned to The Warner & Swasey Co. Patent No. 1,796,639.

Gripping Mechanism. Thomas Patterson, Gary, Ind., assigned to National Tube Co. Patent No. 1,796,763.

Buffer Pad. Harold C. Hatfield, Racine, Wis., assigned to John F. Huber. Patent No. 1,796,787.

Cylinder Hone. Ernest A. Hall, Toledo, Ohio, assigned to The Hall Manufacturing Co. Patent No. 1,796,842.

Method of Making Screw Dies. Jozef Folman, Sosnowiec, Poland. Patent No. 1,796,925.

Milling Cutter. Bertie Sharp, Birmingham, England, assigned to Stanley Charles Icke, Hallscroft, Church Stretton, Shropshire, England. Patent No. 1,797,026.

Micrometer Gage for Internal Threads. Frank J. Bohn, Washington, D. C. Patents No. 1,797,121 and 1,797,122.

Processes

Tempering Steel Strip. Alfred M. Remington, Fitchburg, Mass., assigned to Simonds Saw & Steel Co. Patent 1,796,304.

Method of Making Nut Blanks. Samuel W. Avis, Greenwich, Conn., assigned to Russell, Burdsall & Ward Bolt & Nut Co. Patent 1,796,680.

Method of Treating Objects. Arthur Herman Adams, La Grange, Ill., assigned to Western Electric Co. Patent 1,796,819.

TRADE PUBLICATIONS

BORING MACHINE. The Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., has issued a catalog on the No. 45 high-power precision horizontal boring, drilling and milling machine. The construction of the various assemblies is entered into very fully and each feature is illustrated. Complete specifications are tabulated.

FOLDERS AND BRAKES. The Niagara Machine & Tool Works, Buffalo, N. Y., has issued Bulletin No. 74 on folders and brakes, showing hand types and motor-driven models covering a wide range of capacities. The work that can be done on each type is amply illustrated.

FORGING HAMMERS. The Nazel Engineering & Machine Works, 4038 North 5th St., Philadelphia, Pa., has issued a folder entitled "Economical Forging," describing its motor-driven (air-actuated) forging hammers.

NEW ENGLAND ECONOMIC DATA. The New England Council, 1032 Statler Bldg., Boston, Mass., has published a report entitled "New England Economic Data," which is expected to save time and energy in searching for data of which the source is not known. Each listing has been arranged to show the nature of data, by whom compiled, the frequency of compilation, and where published.

PACKING. The France Packing Co., Tacony, Philadelphia, Pa., has issued catalog "K," illustrating the different types of metallic packing manufactured.

PIPE THREADING EQUIPMENT. The Oster Manufacturing Co., Cleveland, Ohio, has issued a catalog covering a very complete line of pipe threading tools and machines, useful as a reference book. It is of standard size, loose-leaf, and shows several new developments.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, March 26, 1931

VOL. 74 NO. 13

The Brazilian Ban

IT IS said that the Indiana State Legislature once sought to pass a bill establishing the value of the symbol π as 3. Legislators saw no need for making it 3.14159, when anyone knows that a lone digit is much more convenient to remember and use. Now Brazil seems to be making a bid for similar fame. The Provisional Government has banned, for three years, all imports of industrial machinery. The old, old reasons — that overproduction will be lessened and unemployment checked—are advanced, but the feeling is rather general that politics, as usual, has had a large hand in the ban, for Brazil's new government is largely agrarian. In view of Brazil's known inability to produce the industrial machinery she needs and must have increasingly as her industrialization advances, the wisdom of the ban is open to serious question.

To the United States, the decree has some importance. American exports of machinery to Brazil in 1926 were $3,969,833, in 1927 were $5,030,311, in 1928 were $5,391,267, and in 1929 were $6,362,846. Brazil ranks fourth in our Latin-American trade and eleventh in our world market. To England, the decree has even greater importance because present Brazilian imports are largely textile machinery, of which Great Britain supplies eighty per cent. But after all, the importance of the effect is secondary; what deserves major attention is Brazil's willingness to step back a hundred years or more, while the rest of the world moves on. Economically, she cannot afford to do so. Stress of circumstances, providing the embargo is maintained, will force a recurrence of the events that put a provisional government in power.

Russia Evolves

IT HAS been pointed out that many of Soviet Russia's political policies are not essentially Communistic. An outstanding exception was the purely Communistic doctrine of eliminating individual incentive. The news that this principle has been modified on the collective farms is significant. Under the former plan, when a fixed wage was paid, regardless of production, certain individuals did less than their share. The piecework scheme now inaugurated follows a similar change in Russian factories. Thus is an inbred characteristic of human nature recognized and a Communistic doctrine refuted.

There is much that is hopeful in this move—not because a so-called capitalistic principle has prevailed but because a trend is apparent toward Russian economic stability. Such steps as these may yet result in a peaceful evolution and avoid another period of chaos which at one time seemed inevitable.

Versatility Plus Standardization

MACHINES that are designed to make only one size and type of article, and cannot be adapted to other purposes, undoubtedly pay their own way in many cases. But the chances of doing a profitable business with a versatile machine adaptable to a considerable variety of jobs is far greater. This fact is quite generally appreciated.

What seems to be less apparent to some is that reasonable forethought and a fair degree of standardization within a plant often will enable it to build a full line of versatile machines from comparatively few parts.

At least one manufacturer of machine tools is now working on a program of this kind. He expects to build a line of machines to handle both bar and chucking work that will have close to seventy-five per cent of interchangeable parts. With these and only four different frames, and perhaps twenty-five per cent of parts that are not interchangeable, his line will be able to handle about 90 per cent of the production work done on this class of machines. Yet all of the machines will be highly efficient.

As against this, some competitors are said to offer machines involving more than a dozen different frames and a much larger diversity of parts, with no greater range of work. Can it be doubted which of these companies will have the lower average unit cost, and consequently will be in the better position to meet competition?

I—Long Term Planning of Business Operations

B—Initiate research from the customer's standpoint to determine:

(1) To what extent established lines should be replaced, improved or simplified.
(2) What additional markets can profitably be penetrated with these lines.
(3) What new products can logically be added for present and new methods.

RECENTLY the New York *World,* with its associated papers, folded its tent and sold its name to a competitor. Despite a reputation for fearless journalism and the championship of public interests, this paper was faced with an ever-mounting deficit. Its plight was attributed to the competition of conservative dailies such as the New York *Times* and the *Herald-Tribune* on one hand and the tabloids on the other.

This incident contributes to the fund of evidence that business is essentially dynamic. Readers' tastes and consumers' demands do not lie quiescent year after year. Attempts to solve today's problems with yesterday's formula are doomed to failure.

Nowhere are the effects of this principle more striking than in the field of metal working. Changes in demand are intensified by the time necessary for a manufacturer to adjust his plant to product variation. New designs, new patterns, new tooling, and new machines must first be provided. Time is precious. The attempt to overtake a field, already headed on a fresh track, results in an interim of lost earnings. To live and thrive in this competitive era, a manufacturer must be more than quick on his feet. He must anticipate his market of tomorrow by sound prognostication.

Much of our so-styled overproduction, with its accompanying price disruption, is caused by the continued manufacture of goods the consumer has ceased to demand. The short-sighted executive is forced frantically to resort to high-pressure sales methods in an effort to neutralize his lack of manufacturing sagacity. The stability of his business is imperiled and the well being of his employees threatened. The recognized responsibility to those dependent on it for their livelihood makes it still more incumbent on a business to keep its product in line with consumer needs.

Spasmodic endeavors to regain lost ground do not suffice and have no part in a comprehensive program. Financial provision must be made for persistent research to insure undiminished effort in good times and in bad.

Some 161 large corporations entirely escaped the slump of 1930 and actually increased their earnings over 1929. Here is dramatic proof that business foresight can be translated into an adaptability that will rise above conditions.

These ends are not gained by blind luck or an obscure necromancy. The fundamentals of product analysis are widely known but almost as widely neglected. Redesign must be conducted in the light of customer tastes and needs. New markets must be explored. New products must be added when logical. These are the essence of long term product planning.

A company may muddle through and in boom times may be lulled by the palliative of a living profit. But when orders fall off, those who have failed to look ahead will feel the pinch of adversity. Planning the product from the consumers' viewpoint will do much to make a business depression-proof.

NEWS OF THE WEEK

Brazil Restricts Importation of Industrial Machinery

RESTRICTIONS were placed on the importation of industrial machinery into Brazil through the enactment of a new law March 12 by the Legislature of that country. The legislative action places a ban on the importation of industrial machinery for the next three years, unless special license is obtained from the Ministry of Labor and Commerce. The term "industrial machinery" was construed as meaning all factory equipment. The law does not affect orders placed before March 7, but proof of such orders must be submitted within thirty days.

In tracing the reason for the embargo, foreign trade experts point out that the present administration in Brazil is distinctly non-industrial. The present government was formed by parties in the extreme southern states as a protest against the former government that derives most of its support from the industrial section in Sao Paulo and Rio de Janiero. Those who specialize in international trade movements profess surprise that the Brazilian government should take such indirect means to suppress its industrial section when the lowering of the duty on the imports of competing foreign industries would accomplish the same purpose. If a prolonged embargo should be attempted, it is believed certain that another revolution would be the result.

Since the application of the decree presumably is confined to factory equipment, it will apparently make little difference for the time being, since orders along this line have already nearly ceased. Textile machinery is the principal item affected, 80 per cent of which is supplied by the United Kingdom. Only three Latin American countries buy more industrial machinery in the United States than does Brazil. Exports to Brazil in recent years have been in the following amounts: $3,969,833 in 1926; $5,030,311 in 1927; $5,391,267 in 1928, and $6,362,846 in 1929. In the world market for American machinery Brazil ranks eleventh.

In connection with the Brazilian situation, the observations in that country of J. L. Osgood, President of the J. L. Osgood Machinery & Tool Co., Inc., of Buffalo, N. Y., may be of interest. Mr. Osgood has just returned from a 110-day trip to Latin America and Hawaii, on which he traveled some 26,174 miles, observing trade prospects and general industrial conditions. Regarding Brazil, Mr. Osgood says: "I found Brazil quieted down since the bloodless revolution which occurred a few months ago. The population generally is satisfied. The new head is sponsored by the court and the army, and is operating under a much more economical plan. Many abuses in the course of business in the various states have been stopped, and a checking system in all state business is carried on by the national government. It is expected the now de facto head will be elected president, the election to take place in a few months.

"Brazil is larger than the U. S. and has great potential value. It has great forests of valuable timber, a small section of which, if marketed, would pay off the national debt. The government has no available cash, and a plan is being worked out for refunding its debt, but at present it is paying for its needs in promissory notes. The population is 40,000,000. They manufacture 95% of their shoes on American shoe machinery, and some weaving of cottons is done, but very little in general manufacture. The U. S. stands first in supplying the country with machinery, tools, and equipment. One well-known American machinery manufacturer has recently closed a contract with the Brazilian railway for $750,000 worth of repair shop machinery."

Stanley Hale Bullard

Stanley Hale Bullard, 54, vice-president of the Bullard Machine Tool Company, Bridgeport, Conn., died Sunday, March 22, at Bridgeport, after an illness of some months. He was also vice-president of the Bullard Engineering Works, Inc.

At the age of 19, Mr. Bullard began his machinist apprenticeship in the Bullard shop. In 1900, he became a journeyman machinist, and in 1901 a sales representative. In 1909 he was made sales manager, a position which he retained until 1915, when he was made works manager. In 1918, he became vice-president, assisting his brother, E. P. Bullard, in the general management of the entire business. His devotion to the "Bullard Organization" continued until his death, for during the past several months he has been reporting regularly at the office in spite of doctor's orders.

A drop of water has been taken as model by Dr. Oscar G. Tietjens, Westinghouse research engineer, in his studies to cut wind resistance two-thirds in redesigning railway cars for high-speed operation. Streamlining reduces power required 30% at 80 m.p.h.

Technical Program Announced For Triple-M-Congress

THE complete technical program for the Second National Industrial Congress at the Cleveland (Ohio) Auditorium, April 13 to 17, has recently been announced. Plant inspection trips are scheduled on April 14, 15, and 17, and the banquet on April 16. The congress will be under the auspices of the S.I.E., Cleveland Engineering Society, Cleveland Electrical Maintenance Engineers' Association, A.S.M.E., and A.M.A. The program is as follows:

Monday, April 13

SCRAP HANDLING SESSION

"Handling of Thin Sheet Scrap in Tin Plate and Sheet Steel Mills" By H. H. Giles, American Sheet & Tin Plate Co.

"Handling of Automobile Body Scrap" By R. R. Reese, Plant Engineer, Packard Motor Co.

"Briquetting of Cast Iron Borings and Steel Turnings" By A. K. Nowak, Baldwin Southwark Co.

Discussion of Handling and Disposition of Ferrous Scrap.

WASTE ELIMINATION SESSION

"Segregation and Control of Waste" By C. H. McKnight, Supervisor, Inventory Control, General Electric Co.

"Waste Campaign Experiences and Suggestion Systems" (Short talks giving experiences from several companies.)

Tuesday, April 14

MANAGEMENT SESSION

"Developments in Manufacture of Lead Covered Paper Insulated Telephone Cables" By J. R. Shea, Asst. Engr. of Manufacture, Western Electric Co.

"Planning a Lead Covered Telephone Cable Manufacturing Plant" By L. C. Hanley, Western Electric Co.

HOISTS AND MONORAIL HANDLING SESSION

"Monorail Handling of Materials" By C. W. Preston, Majestic Household Utilities Co.

"Engineering Factors in the Use of Electric Hoists" By H. J. Fuller, Engineer.

"Bulk Handling Methods for Pipe" By E. W. Burgess, A. O. Smith Co.

DRAFTING ROOM MANAGEMENT SESSION

"Production Management Applied to the Drafting Department" By W. J. Kunz, Combustion Engrg. Co.

"Improved Drafting Room Management" By F. D. Newbury, Westinghouse Elec. & Mfg. Co.

MANAGEMENT SESSION

"Distribution and Marketing" By Gorton James, V. Pres., Thompson & Lichtner Co. Inc.

Wednesday, April 15

PLANT INSPECTION TRIPS

CONVEYOR HANDLING SESSION

"Synchronization of Production Control and Conveyorization" By E. M. Olin, Works Mgr., Westinghouse Elec. & Mfg. Co.

"Materials Handling for Mass Production at Gen. Elec. Plant" By H. C. Rundle, Gen. Elec. Co.

OUT DOOR HANDLING SESSION

"Handling Equipment for Bulk Materials and Special Purposes" By Arthur F. Case and Paul M. Douglas, Wellman Engrg. Co.

"Remote A. C. Controlled Haulage at the Plant of the Trinity Portland Cement Co." By R. F. Emerson, Indus. Engr., Genl. Elec. Co.

"Industrial Type of Internal Combustion Engine Locomotive" By S. B. Schenck, Westinghouse Elec. & Mfg. Co.

DESIGN HANDLING EQUIPMENT SESSION

"Application of Two Speed Motors to Electric Hoists" By C. E. Schirmer, Robbins & Myers.

"Variable Speed Transmission for Materials Handling" By D. W. Clem, Reeves Pulley Co.

"Types of Materials to Use in Materials Handling Equipment" By Harvey Skinner.

MANAGEMENT SESSION

"Skills and Satisfaction" By Dr. Lillian Gilbreth, Pres., Gilbreth Inc.

TRUCKING AND SHIPPING SESSION

"Skids and Skid Shipments" By R. L. Lockwood.

"Use in Marine Terminals" By H. E. Stocker.

"Use in Railroad Terminals and Stores" By J. B. Miller.

"Handling on Skids" By C. C. Stuber, Mgr. Ind. Trans., Goodyear Tire & Rubber Co.

"The Use of Gas Trucks and Tractors in Materials Handling" By Geo. E. Hagemann, Editor, Alexander Hamilton Institute.

Thursday, April 16

ORGANIZATION SESSION FOR MAINTENANCE ENGINEERS

"Variations in Maintenance Costs and Procedure" By E. B. Stoody, and G. I. Ross, MacDonald Bros.

"Departmental Analyses and Wage Incentives" By W. G. Uhlir, Cons. Engr.

"The Control of Non-Productive Costs" By Harry W. Benton, Plant Engr., Pratt & Whitney Co.

"Organization and Operation of the Electrical Maint. Dept." By Sid. Watkins, Chief Elec., Warner & Swasey.

MATERIALS HANDLING SESSION

"Automatic Electric Control of Materials Handling" By J. E. Wood, Monitor Controller Co.

"Pneumatic Handling of Vegetable Potash" By J. F. Barnard, Ch. Engr., U. S. Indus. Alcohol Co.

"Handling Small Packages in the Shop" By C. A. Fike, Westinghouse Elec. & Mfg. Co.

OPERATING SESSION FOR MAINTENANCE ENGINEERS

"Maintenance of Electric Cranes and Hoists" By Robt. W. Walton, Shepard-Niles Corp.

"Tools for the Maintenance Engineering Departments" By T. A. Keefer, National Cash Register Co.

"Inspection for Preventive Maintenance" By A. Heckman, Westinghouse Elec. & Mfg. Co.

MATERIALS HANDLING SESSION

"Use of Rubber Products for Materials Handling" By H. E. Cook, B. F. Goodrich Co.

"Weighing and Counting Devices Used on Material Handling Equipment" By A. B. Jacobus, Fairbanks Co.

Friday, April 17

HOUSEKEEPING SESSION FOR MAINTENANCE ENGINEERS

"Maintenance of an Industrial Illumination System" By R. C. Smith, Western Electric Co.

"Maintaining the Lighting System" By Walter Sturrock, Nela Park, General Electric Co.

"Maintenance Painting" By T. J. Maloney., New Jersey Zinc Company.

MATERIALS HANDLING SESSION

"Handling Bulk Materials Mechanically" By W. W. Sayers, Link-Belt Co.

"Uses and Application of Portable Belt Conveyors" By J. B. Bray, V. P., Fairfield Engrg. Co.

"Handling of Materials in Automotive Machine Shops" By N. H. Preble, J. B. Webb Co.

A REPORT on "Budgetary Control in Manufacturing Industry," to be published by the National Industrial Conference Board, sets forth a practical step toward stabilization of employment and scientific regulation of production.

Propose National Standard For Leather Belting

The beginning of work on the development of national standard specifications for leather belting to permit the purchase on a scientific basis of the $30,000,000 worth of leather belting for driving machinery required annually by industry, has been approved by the American Standards Association. Work on the project will be undertaken immediately by a technical committee made up of representatives of manufacturers, distributors, large industrial users of leather belting, and the government.

Arbitration Code Published by A.A.A.

The American Arbitration Association has published a Code of Arbitration Practice and Procedure, presenting for the first time in this country a standard, organized practice of arbitration now in use by business men and attorneys which may be applied to the settlement of business controversies in any jurisdiction in the United States. The Code will be distributed by the Commerce Clearing House, Inc., Loose Leaf Service Division, Corporation Trust Co.

Employment to be Major Topic At Metal Trades Convention

THE National Metal Trades Association will hold its Thirty-third Annual Convention at the Hotel Sinton, Cincinnati, on April 15 and 16. Among the most important subjects to be discussed will be: Stabilization of Employment; Unemployment Insurance, public and private; Employee Training and Supervisory Development; Industrial Research; The Economics of Depressions, and What the Machine Has Done to the Wage Worker.

Principal speakers will include: Glenn Bowers, Director of Research, Industrial Relations Counselors, Inc.; James D. Craig, Chief Actuary, Metropolitan Life Insurance Co.; M. B. Folsom, Assistant to the Chairman, Eastman Kodak Co., Rochester, N. Y.; Magnus W. Alexander, President, National Industrial Conference Board; Harold S. Falk, Vice-President and Works Manager, The Falk Corporation, Milwaukee, and Franklyn Hobbs, Director of Research, Central Trust Co. of Illinois, Chicago, Ill. C. F. Kettering, in charge of development and experimental work for General Motors, is expected to give the banquet address.

The Convention proper will be preceded by a two-day business session of branch secretaries.

Bolt Maker's Group Dissolved as Trust

The Bolt, Nut, and Rivet Manufacturers' Association, composed of fifty of the country's largest makers of steel and machine products, controlling about 95 per cent of the trade, has been ordered dissolved under the Sherman anti-trust law. The order is in reality a consent decree entered in the Federal Court for the Southern District of New York on March 17, and is the result of a long series of conferences between representatives of the association and the Department of Justice. The decree provides for dissolution of the present association within 90 days, but reserves to the defendants the right to form another association. Practices of the association specifically declared unlawful include its distribution plan, its method of establishing base prices, and its system of establishing basing points. Individual companies are not prevented from taking action along those lines, however, the terms of the decree referring only to action "by mutual agreement, understanding, plan, device, or contrivance."

Charles J. Graham, President of the Association, who is largely responsible for the plan of action and the group activities, commented upon the action as follows:

"Throughout the past year, the Bolt, Nut and Rivet Manufacturers' Association has been engaged in conferences with the Department of Justice in respect to the legality of a portion of its plan of operation.

"In order to bring all of its operations in line with the present policy of the Department, it has finally agreed to the entry of a consent decree which forbids concerted action among its members in regard to some features of its activities. The decreee also provides for the dissolution of the present Association within ninety days after its entry, but specifically reserves to the defendants the right to form another association.

"By this disposition of the matter, the industry avoids the expense and annoyance of a long litigation. Immediate steps will be taken to organize a new association which will so operate as to be free from any criticism on the part of the Government.

"Final disposition of this case by agreement, on the basis described, is very satisfactory to the manufacturers."

Steel Founders Meet in Columbus

Representatives of 69 steel foundries met for a "Sales Clinic" at the Neil House, Columbus, Ohio, March 19-20, to discuss the problems of the steel foundry. The meeting was under the direction of the Steel Founders' Society of America, Inc., with W. W. Powell of the Mesta Machine Co., Pittsburgh, acting as chairman.

Subjects discussed included the competition of welded structures, and it was shown that while welding has given serious competition to the ordinary carbon steel casting, it will not seriously affect the alloy casting industry. Price cutting came in for serious consideration. The Society has adopted a uniform accounting system for better determination of costs, and the opinion was that quality, not price, should be the aim of manufacturers. It was variously expressed that users of steel castings are not yet fully aware of the great improvements that have been made in alloy castings during the last few years.

BUSINESS ITEMS

The American Propeller Co. is moving its entire plant to a new building at South Bend, Ind. This company, formerly the Paragon Engineers, is now a division of the Bendix Aviation Corporation. Miles H. Fairbank is general manager.

The Soulé Steel Co., San Francisco, has moved its general offices to its new administration building adjoining its warehouse and manufacturing plant at 1750 Army St., corner Missouri St.

The Foster Wheeler Corporation has purchased the plant and business of the D. Connelly Boiler Co, Cleveland.

Philco Products, Ltd., of Canada, which established an assembly plant in Toronto last May, has leased, in the former Dodge Motor Co. building, 16,000 sq.ft.

The Mill & Mine Supply Co., Seattle, has occupied its new shop and warehouse at 2700 Fourth Ave., South.

The Speeder Machinery Corporation, Cedar Rapids, Iowa, has doubled its capital stock from $500,000 to $1,000,000, to supply necessary working capital for an expansion program, according to George T. Ronk, President and General Manager.

The Gopher Machine & Tool Works has opened its 6,000-sq.ft. new building at 51 Royalston Ave., North, Minneapolis, Minn.

Erection of a factory in Oakland, Calif., is planned by the Wilson Machinery Co., according to an announcement by C. B. McKee, manager. The concern has its Oakland office at 919 Eighteenth St.

Castings of Canada, Ltd., has been incorporated by Dominion charter with head office at Ottawa, Ont. Authorized capital is $250,000. The company is empowered to carry on the trades and business of iron masters and of manufacturers and rollers of steel and iron into any and all forms.

The Ohmer Fare Register Co. has established sales offices at 333 East Eighth St., Cincinnati, with F. H. Dickey in charge.

The Columbia Graphophone Co., Ltd., and the Gramophone Co., Ltd., British subsidiary of the Radio Corporation of America, merged March 20. The new company will be capitalized at approximately $30,000,000. Both Victor and Columbia products will be manufactured.

PERSONALS

Dr. James Aston, inventor of the Aston process for mechanical puddling of wrought iron, has been made 1931 chairman of the Pittsburgh section, A.I.M.E. Dr. E. A. Holbrook of the University of Pittsburgh is vice-chairman.

Earl K. Baker of the Baker Wheel & Rim Co., Detroit, has been elected a director of the Hoover Steel Ball Co., Ann Arbor, Mich.

John W. Blackford, for the past 8 years with the Torrington Co., for the last two years as manager of the Detroit office, has joined the sales organization of the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

H. E. Bromer, Metallurgist of the Standard Foundry Co., Racine, Wis., spoke on "Electric Furnace Iron and What It Means to the Automotive Engineer," at the March dinner meeting of the Milwaukee section, S.A.E.

T. A. Burdick, formerly chief engineer of the General Water Works & Electric Corporation, Fort Worth, Texas, has been appointed manager of the power division of Alco Products, Inc., a subsidiary of the American Locomotive Co., New York.

H. V. Coes, Manager of the Industrial Department of Ford, Bacon & Davis, Inc., New York, spoke on "Administration Problems of Today" at the March 24 dinner meeting of the Brooklyn-Queens group, Society of Industrial Engineers.

B. P. Coulson, Jr. and H. N. Hackett of the General Electric Co., spoke on "Design, Construction, and Operation of Mercury-Vapor Generating Units" at the March 24 meeting of the Philadelphia Local Section, A.S.M.E.

Arthur H. Deute, who resigned as vice-president and general manager of Billings & Spencer Co., Hartford, Conn., early this year, has joined the Hamman-Lesan Co., Los Angeles.

P. S. Dickey, who for several years has specialized in automatic combustion control problems for the Bailey Meter Co., Cleveland, has been appointed research engineer.

Philip Rogers
President of the combined Millers Falls and Goodell-Pratt companies

GEORGE U. HATCH
Vice-President of the combined Millers Falls and Goodell-Pratt companies

Henry B. Dirks, member for 12 years of the engineering department, Michigan State College, East Lansing, Mich., has been appointed dean of the department.

Dr. P. V. Faragher of the Aluminum Company of America spoke on "The Structural Application of New Aluminum Alloys" at the March 26 meeting of the Waterbury Local Section, A.S.M.E.

E. C. Gray has been appointed New York office manager for the Yates-American Machine Co., Beloit, Wis., to succeed D. S. Oakley, now district manager at Detroit for the J. A. Fay & Egan Co., Cincinnati.

William E. Hall has been elected president of the Duriron Co., Inc., Dayton, Ohio, to succeed the late P. D. Schenck. Dudley H. Miller and John R. Pitman are vice-presidents, and Mr. Miller is also general manager. Robert C. Schenck is secretary and E. B. Thacker, treasurer.

Thomas Holloway, formerly with the Farrel Foundry & Machine Co., at Buffalo, has joined the United Engineering & Foundry Co., Pittsburgh, as gear consultant.

William H. Hulick, Vice-President of the Warren Foundry & Pipe Corporation, Phillipsburg, N. J., recently retired after 41 years' service.

B. J. Larkin, recently connected with the J. I. Case Plow Works, Inc., Racine, Wis., has been appointed manager of the Algoma (Wis.) Foundry & Machine Co.

Lewis B. Lindemuth, consulting engineer, has been appointed vice-president and general manager of the Marine Steel Corporation, New York. The company is developing the use of corrosion-resistant alloy steels in marine applications.

Joseph F. Heil has been elected a director and vice-president of the Heil Co., Milwaukee, manufacturer of welded steel motor truck bodies, hydraulic hoists, and similar items. He is also treasurer of the Milwaukee Air Power Pump Co., and the Combustion Oil Burner Co., divisions of the Heil Co. Bert W. Fueger has been elected vice-president of these divisions, and Herman W. Falk, President of the Falk Corporation, has been elected a director.

Rear Admiral Louis R. de Steiguer, Commandant of the Brooklyn Navy Yard, retired March 17, was succeeded by Rear Admiral William W. Phelps.

N. A. Woodworth was elected president and treasurer of the Ex-Cell-O Aircraft & Tool Corporation at the recent stockholders' meeting. Phil Huber was elected vice-president and secretary, J. W. Rothmeyer, vice-president in charge of the Krueger-Wayne Division, Thor M. Olson, vice-president in charge of the Continental Tool Division, H. R. Krueger, vice-president in charge of engineering, William F. Wise, vice-president in charge of sales, and Glen Bixby and F. F. Murphy, assistant secretaries.

OBITUARIES

Henry Clay Graton, 100, one of the oldest industrialists in the United States and founder of the Graton & Knight Co., Worcester, Mass., in 1851, died March 20 there. He had retired ten years ago.

Alfred Bishton Botfield, 83, originator of high-temperature cement and founder of that industry in the United States, died recently in Miami, Fla. Mr. Botfield established the Botfield Furnace Specialties Co., in Philadelphia, which has now become the Botfield Refractories Co., under the presidency of his son.

Charles W. Cowherd, 65, for 30 years superintendent of the Brantford, Ont., works, Cockshutt Plow Co., died there March 14.

Charles W. Darrow, 65, for 20 years president of the Darrow Sheet Metal Works, Benton Harbor, Mich., died recently there.

Charles S. Knight, Jr., 67, sales manager of electrical and wire rope for the American Steel & Wire Co., Chicago, died March 11.

Olof Langley, 47, Chief Engineer of the United States Lead Refinery, Inc., East Chicago, Ind., died March 14.

John R. Mulcare, 58, district manager of the American Car & Foundry Co., died recently at his home in Buffalo, N. Y., following a brief illness.

Joseph S. L. Wharton, 80, associated with the foundry industry in Philadelphia for more than 50 years, died of heart disease March 17. He was president of the Cochrane Corporation, which evolved from the J. S. L. Wharton Foundry, established by his father.

Howard C. Woglom, 57, who retired in 1926 as plant manager for the Taylor & Fenn Co., Hartford, Conn., after eight years' service in that capacity, died March 7.

FORTHCOMING MEETINGS

THREE-M-CONGRESS — Management, Maintenance, and Materials Handling Congress and Second National Industrial Equipment Exposition, Cleveland, Ohio, April 13-18, 1931. In the Arena and Exhibit Hall, Cleveland Public Auditorium. Information from the A.S.M.E., 29 West 39th St., N.Y.C.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.
National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.
National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN FOUNDRYMEN'S ASSOCIATION—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

NATIONAL FOREIGN TRADE COUNCIL—Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2. Headquarters, 20 Vesey St., N. Y. C.

NATIONAL ASSOCIATION OF PURCHASING AGENTS—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, Secretary-Treasurer, 11 Park Place, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

Still another week has passed with little change. Amtorg orders continue, in fact increase, but since they go direct to manufacturers they bring little cheer to dealers here. Simonds is doing some choosing of special machines for the new Fitchburg plant, but these aid New York dealers not a whit more, since they are outside the territory. In several cases, however, the week showed a good total. One dealer has had an occasional $20,000 day—but they are still too few and too far between. March is expected to average better than February, and there is an ever-increasing amount of business "in the wind," though much of it does not appear as actual inquiry. Possibilities nowadays are "worked up"; rarely do they arise as an inquiry.

CLEVELAND

The first quarter of 1931 will show appreciable gains in sales of machine tools over the last quarter of 1930. Dealers and manufacturers are much encouraged over the improvement made in orders closed and inquiries received since the first of the year. Buying, although slow, is steady. Inquiries are on a more liberal scale. The amount of new business pending is larger than any time during 1930.

Sales for the last ten days were spotty. The only outstanding feature was the order received by a local dealer for ten lathes for the Dayton Aircraft field.

CHICAGO

No perceptible improvement has developed within the week. If anything, there has been a further recession in both inquiries and sales, and there are not a few leaders in the machinery field who hold to the opinion that unless industrial production throughout the country develops a decided increase in the near future, the outlook for a good summer trade will not prove encouraging. With a few exceptions, inquiries thus far this year have been mainly for railroad shop equipment, and such concerns as specialize in this class of machinery are regarded as fortunate. Railroad inquiry during the last week brought out the following: the Santa Fé is asking quotations on a multiple punch; a 24x3-in. high-speed wheel-spring frame grinder; a 12-in. bench drill, and a 600-ton double-end car wheel press. The C.,M.,St.P.&P. has added an emery grinder to its list. Demand for used tools is unchanged.

SOUTHERN DISTRICT

The machinery and machine tool trade has been experiencing a noticeably better business trend. Sales have not been great, and neither has there been a demand of particular significance either as to quantity or geographical location. But the odds and ends of inquiry have been scattered and bear evidence of a generally improved condition among the various industries. Probably the poorest single factor has been the lack of buying interest in the oil industry. Prices and lessened consumption in comparison with previous satisfactory levels probably are responsible for the conservative replacements in this division. Chief interest centered in the Southwestern section where new machinery and equipment (chiefly small lots) showed improvement. Used types of various kinds were lacking in demand, and an increased volume of stocks were noticeable the past fortnight. Construction operations in and about Louisiana have added some inquiry to jobbers for this particular line of equipment, but the effect on machine shop inquiry has been negligible. Used equipment prices show some fluctuation, with a slight evidence toward "dumping" of types held too long.

IMPROVEMENT during the first quarter is rather generally conceded, even though week-to-week evidence points to little change. The feeling exists that the bottom has been passed, and demand will henceforth increase slowly and steadily. Demand is inclined to be spotty, both as to geographical location and as to dealer or manufacturer. Reports of a good day or week are followed by a slacking up, and vice versa. Inquiry is uniformly good, some of it depending on distant futures. The reliable way to get orders, however, consists of the old dependables, shoe leather and persistence.

NEW YORK has occasional good days which maintain conditions at their previous levels. Since Amtorg orders go direct to manufacturers, they make little difference to dealers. Cleveland expects the first quarter to show appreciable gains, but the last ten days were spotty, except for a 10-lathe order. Chicago is slow, except for railroad inquiry, and expects little change until fall. Southern District orders, on the contrary, are improving steadily, with inquiries leading the way. Cincinnati dealers and manufacturers alike report improvement, principally in the direction of increased efficiency equipment.

DETROIT general business is improving and this leads to better feeling on the part of tool dealers. Philadelphia has prospects of early shipbuilding buying, some indications of railroad demand, and otherwise quiet summer prospects. New England orders are assuming a better level, with inquiries fairly numerous. Milwaukee's progress is slow, but healthy.

CINCINNATI

A shade better demand and a better general market tone has developed. Business booked last week was well diversified and well scattered, principal buyers being general machinists and miscellaneous users whose requirements were principally single tools. Local selling agents did not close many sales but had considerable success in developing prospects. Manufacturers received a fair volume of well-diversified and well-scattered single inquiries from miscellaneous users. Several manufacturers find encouragement in the fact that an increased number of inquiries are being reported to them by out-of-town selling agents. The trend seems to be toward the purchase of efficient tools to replace old equipment, this being indicated by tentative orders under consideration.

DETROIT

General business continues to improve in the Detroit area. With increased sales and the much more rapidly growing optimism in the automotive and associated lines of industry, there has come a steady improvement in the outlook for the machinery and machine tool trade. While it is still true that the advance in auto production has not brought a flood of machine orders, it is also true that the inquiries are increasing in volume and in significance and the prospects for a healthy improvement are growing better every day.

For several weeks the atmosphere here has been lifting. Business men, industrialists, and the general public seem to be agreed that good times have come back, and they are acting accordingly. This seems to augur very well for the immediate future.

PHILADELPHIA

Prospects of early buying from shipyards in this territory was one of the bright spots during the last two weeks. There are better prospects from that industry than any of the others, although some dealers and sales agents profess to see an improvement in the railroad situation before long. So far as other industries are concerned, the situation is virtually where it was two weeks ago, with little indication of activity in the near future. Inquiries have not been brisk, and as a whole there is considerable lethargy.

NEW ENGLAND

It is encouraging that New England business has not receded since the first of the year. True, the step up all along has been small, but in most cases has been maintained. Orders for machine tools are gradually assuming a better level, and the current week for some houses was the best of the month. Inquiries are fairly numerous.

Industrial conditions taken as a whole are better than at any time since November. Recently better prospects have developed in the steel, aeronautical, and drop forging industries. In the latter field, the Moore plant at Springfield has added a force of 200 for night work.

Aeronautical manufacturers expect early improvement due to new government orders. Sikorsky is building a number of large special planes for the Chilean Government. The trade is just now interested in a volume of prospective orders for special machinery to equip the new Simonds plant at Fitchburg.

MILWAUKEE

Reports indicate slow but healthy progress. Conditions are still far from being satisfactory, but enough orders are being secured to show a volume that exceeds that of the past several months. One manufacturer stated that his March volume was 200 per cent over February, but pointed out that this has not brought business up to normal. Inquiries and pending lists are taken to indicate favorable prospects for the near future. Orders continue to come from diversified sources.

According to local sources, Detroit automotive industries are already in the market and are expected to place additional business with Milwaukee manufacturers. Westinghouse and General Electric are also reported to be factors. The railroad situation is also said to be more favorable, and the Pennsylvania Railroad electrification project is looked to not only to result in machine tool business but for its psychological effect on other large industries.

BUSINESS • BAROMETER

Taking the country as a whole, the outlook for general business seems to be improving

THEODORE H. PRICE
Editor, Commerce and Finance, New York

SILVER advanced again last week. At the top it was five cents above the low touched in February, 1931, when it sold at 25¾ cents an ounce. It has receded to 29¾ cents. The advance means a great deal to Oriental trade, as the gold standard has never been wholeheartedly accepted by the merchants of the East, who insist upon using silver in their business intercourse with the native population. This population is, by the way, the densest in the world. Java, for instance, which has an area of only 51,000 square miles has 35,000,000 inhabitants, whereas but 44,000,000 people live in the 95,000 square miles that constitute Great Britain and Northern Ireland.

This aspect of the situation is stressed because an advance in the price of silver is more important than most American business men appreciate. No one knows how much silver is held in the Far East. It is hidden away in all sorts of impossible places. But the amount must be enormous, and an increase of 20 per cent in the purchasing power of silver money or credit that is used in Asiatic business ought to mean a sensational increase in the volume of goods that the East has been in the habit of buying from the West.

Some insist that the importance of the silver question has been exaggerated. They maintain that the nominal re-establishment of a fixed price for silver was agreed upon by the European powers some years ago, and that it will soon be recognized. But those merchants who are familiar with Oriental conditions and habits insist that the Asiatics will not surrender silver as a medium of exchange, and that it will continue to have a profound effect upon the world's trade in general, and the market fluctuations for those things that are used in the Orient.

It is quite possible that last week's advance in the New York stock market may have been the result of the rise in silver. As an explanation of the advance it is an appealing hypothesis, and the minds of Western business men are becoming silver conscious for the first time since Bryan was defeated in 1896. This is not to say or to imply that there is any possibility that the silver standard will be re-established in America. It is, however, possible that it will supply us with a new political issue from which we can draw inspiration or discouragement as we see fit.

The markets have not been especially interesting otherwise. On the Stock Exchange the only significant movement has been a decline in railroad stocks, which reflects among other things the fear of the buses and trucks that are becoming so numerous. That some effort to organize this new branch of the transportation movement will soon be made is inevitable. But great bodies move slowly, and it will take time for the Interstate Commerce Commission to gather the information upon which it will insist before recommending any corrective measures.

THE BUSINESS WEEK

March 25, 1931

The Ides of March have come and gone without furnishing any further unfavorable omens from the economic oracles or throwing any new light on the outlook either. . . . Slow but steady seasonal improvement continues undisturbed by new developments. . . . Steel production, supported by diverse short-range demand, is rising to its spring peak at somewhat more than its usual seasonal rate; and building is beginning to reflect the strong stimulus of public works contracts. . . . Check payments show the effects of abnormally high government financial turnover. . . . Other indicators continue monotonously horizontal, and domestic textile activity is apparently tapering off a bit. . . . Our index has risen again, above the level of recent weeks, to 81.1% of normal, where it was early in the year. . . . Commodity price movements are encouragingly indefinite, as in March last year, but the spectacular strengthening of silver and an advance in steel are possibly significant. . . . The bond market continues a conservative, exclusive affair, but steady bank buying of non-government bonds is bullish, though as yet insufficient to offset continued unseasonal contraction of commercial credit. . . . As in recent weeks, the improved tone of foreign feeling remains the most favorable forecasting factor.

©The Business Week

Taking the country as a whole, the business outlook seems to be improving. The worst feature is the decline in railroad earnings that is reported by many large transportation companies. The railway managers are, as a rule, optimistic, and predict an improvement that will arrive just as soon as the crops are harvested. Most of the department stores insist that they are doing an excellent trade, but the owner of one of them was candid enough to say that he advised his competitors not to forget that the business now handled in the larger cities meant a loss in trade to the little towns with whom the country folk no longer dealt, and that gains in trade shown by Big Town A at the expense of Small Town B might be very misleading. But this is a nice distinction that can be disregarded if there is a real revival in business, of which many people seem to be highly confident.

The Carnegie Steel Works announce another advance of $1 a ton for steel bars, shapes, and plates. A similar advance was ordered last November when the price was lifted from 1.60c. to 1.65c. per pound. The recent rise is partially attributed to an order for 125,000 tons of steel to be used in the construction of New York's "Radio City."

Copper is down to 10 cents a pound, at which figure the demand is but moderate. Cotton goods are in quite active demand, but buyers are a little more patient than they appeared to be last week. The commodity markets tell their own story. None of them have changed much, but cotton is showing distinct strength, and its stolidity is very puzzling to those who insist upon knowing why the market goes up or down. This is impossible, as the cotton market is not and never was rationalistic. It is, however, impossible to deny the fact that some unseen influence is at work in cotton.

Viewing the situation broadly, there seems to be no reason for any substantial decline in commodity prices. This is not to say that a general advance impends, but the bears have not made much headway since last December. Some essentials show a slight advance, and others are a little lower, but upon the average the change is not great, and merchants of experience are agreed that an advance in prices generally follows a long period of stability.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

BARS, shapes and plates have been marked up 5c. per 100 lb., to $1.70, Pittsburgh, for second-quarter delivery. This means, probably, that buyers of large tonnages will continue to pay $1.65 for a time, at least. Current demand, for the most part, is made up of automotive and construction materials. Tin advanced ½c. per lb., to 29½@30½c., at New York warehouses, during the week. Most of the other non-ferrous metals slumped, the movement extending to fabricated brass and copper and also to scrap, except heavy lead.

(All prices as of Mar. 20, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	19.91@ 20.41
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	18.26@18.76
Virginia No. 2 (Silicon, 1.75@2.25)	22.29
Basic	17.25@ 17.50
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	17.00
Basic	17.00
Bessemer	17.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Quotations are in cents per pound for sheets from warehouse stock; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	1.90	3.35†	3.00	3.00†
No. 12	1.95	3.45†	3.10	3.05†
No. 14	2.05	3.55†	3.20	3.10†
No. 16	2.15	3.65†	3.30	3.20†
Black				
Nos. 18 to 20	2.15@2.25	3.60†	3.40	3.30
No. 22	2.30@2.40	3.75†	3.55	3.45
No. 24	2.35@2.45	3.80†	3.60	3.50
No. 26	2.45@2.55	3.90†	3.70	3.60
No. 28	2.60@2.70	4.05†	3.85	3.75
Galvanized				
No. 10	2.20@2.30	3.65†	3.50	3.35
Nos. 12 to 14	2.30@2.40	3.75†	3.60	3.40
No. 16	2.40@2.50	3.85†	3.70	3.50
No. 18	2.55@2.65	4.00†	3.85	3.65
No. 20	2.70@2.80	4.15†	4.00	3.80
No. 22	2.75@2.85	4.20†	4.05	3.85
No. 24	2.90@3.00	4.35†	4.20	4.00
No. 26	3.15@3.25	4.60†	4.35	4.25
No. 28	3.40@3.50	4.85†	4.70	4.50

*Light Plates. †400 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.275	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.585	2.875	2.469	.203
3	.765	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness		Outside Diameter in Inches						
		½	⅝	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or .125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.15
Hoop steel	3.75†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.85†	5.30	5.00†
Cold fin., round or hexagon‡	3.40	3.65	3.35
Cold fin., flat or square‡	3.90	4.15	3.85
Structural shapes	3.10†	2.95	3.00†
Soft steel bars and bar shapes	3.10†	2.95	2.90†
Soft steel bands	3.40†	3.20	3.10†
Rivets, structural or boiler	4.25	....	4.00
Tank plates	3.10†	3.00	3.00†
Bar iron (2.75 at mill)	3.24	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, $\frac{3}{16}$-in. thick by $\frac{3}{4}$-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{2}$, 7.35c. per lb.

METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

Copper, electrolytic, New York			11.50@12.00
Tin, Straits, pigs, New York			29.50@30.50
Lead, pigs, E. St. Louis	4.25	New York	5.50 @6.50
Zinc, slabs, E. St. Louis	4.00	New York	5.50 @6.50

	New York	Cleveland	Chicago
Antimony, slabs	10.00@10.50	10.50	10.75
Copper sheets*	20.37½	19.87½	20.00
Copper wire*	12.00	12.12½	12.12½
Copper, drawn, round*	18.87½	18.87½	18.50
Copper tubing*	22.87½	22.37½	22.50
Brass sheets, high*	17.62½	17.25	17.37½
Brass tubing, high*	22.50	22.12½	22.25
Brass rods, high*	15.87½	15.50	15.62½
Brass wire, high*	17.75	17.75	17.87½

*Mill. base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	24.00@25.00	24.30	23.30
Zinc sheets (casks)	9.75@10.25	11.25	10.36
Solder (½ and ½)	22.00	21.50	18@20

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	45.25
Commercial genuine, intermediate grade	34.25
Anti-friction metal, general service	29.00
No. 4 babbitt, f.o.b.	10.00

†F.O.B.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	8.00	7.75	7.25@7.75
Copper, heavy, and wire	7.25	7.50	6.75@7.25
Copper, light, and bottoms	6.25	6.50	6.00@6.50
Heavy lead	3.25	3.50	3.00@3.50
Lead battery plates	1.25	2.50	2.00@2.50
Brass, heavy, yellow	4.25	4.50	4.00@4.50
Brass, heavy, red	6.75	7.00	6.25@6.75
Brass, light	3.50	3.25	3.50@4.00
No. 1 rod-brass turnings	4.50	4.50	4.25@4.75
Zinc	1.50	1.50	1.25@1.50

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13	$0.16	$0.15
Cotton waste, colored, per lb.	.09½	.12	.10
Wiping cloths, washed, white, per lb.	.15	38.00 per M	.14½
Sal soda, per lb.	.01¼	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.10	.099	.104
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	50%
Med. grade, heavy wgt.	30%	30 –5%	40%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	70%	50–10%	60%
Second grade	65–5%	60– 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.031	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1587½	.1537½	.2125
Solder (½ and ½)	per lb.	.22	.22	.275
Cotton waste, white	per lb.	.13	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.75	.75
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65–10%	65–10%	50–10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.50
Coke, prompt foundry, per net ton	Connellsville,		3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65–10%
Larger, up to 1 x 30-in., full kegs, list less	65–10%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65–10%
Larger, list less	65–10%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.25
Structural, round head, broken kegs, net	5.75
Tank, 7/16-in. dia. and smaller, list less	60–10%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65–10%
Larger, up to 3-in., list less	65–10%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$3.50
Wrought, broken kegs, per 100 lb., list less	1.50
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

O., Cleveland—H. J. Bowie Co., 9205 Inman St. (machine and metal shop)—punch press.

O., Cleveland—A. Gent, 5810 Richmond Rd., South Euclid (automatic screw works)—screw machine.

O., Cleveland—C. E. Sutherland, 3970 Bluestone Rd. (metal stamping)—punch press or kick press.

Pa., Erie—Bd. of Education, R. S. Scovell, Secy., Library Bldg.—woodworking and metal working equipment, etc. for proposed 1 story, 40 x 270 ft. technical high school.

Opportunities for Future Business

Ala., Montgomery — Constructing Quartermaster, received lowest bid for the construction of air corps warehouse, machine and assembly shops at Maxwell Field from Batson-Cook Co., West Point, Ga. $61,500. Noted Jan. 29.

Calif., Los Angeles—Fields Chemical Corp., 122 Financial Center Bldg., plans the construction of first unit to metallurgical coke plant, 20-ton daily capacity.

Colo., Pueblo—J. W. and A. D. Field, 36 West 59th St., Kansas City, Mo., plans the construction of a sanitarium and health resort, including sawmill, etc. J. F. Codding, Rye, Colo. in charge.

Conn., Bridgeport—Dugan Bros., Inc., Glenwood Ave., awarded contract for a 1 story, 60x 200 ft. service building on Boston Ave. Estimated cost $60,000. Noted Mar. 5.

Idaho, Pocatello—Union Pacific R.R., 15th and Dodge Sts., Omaha, Neb., plans improvements to timber treating plant here. Estimated cost $30,000. G. J. Adamson, Omaha, Ch. Engr.

Ind., Hammond—Standard Steel Specialty Co., awarded contract for a 1 story, 50x200 ft. addition to factory at Clark Ave. and 142nd St. Estimated cost $42,000.

Mass., Belmont—Electric Light Dept., Concord Ave., awarded contract for a 1 story, 50 x 110 ft. garage, etc. at Waverly Ave. Estimated cost $45,000. Noted Feb. 19.

Mass., Billerica—Boston & Maine R.R. Co., 150 Causeway St., awarded contract for the construction of a round house. Estimated cost $45,000. G. A. Kirley, Boston, Mass., Ch. Engr.

Miss., Natchez—Mississippi Match Co., subsidiary of International Match Co., Jackson, awarded contract for the construction of a factory including two warehouses and five outbuildings. $107,934. Noted Mar. 19.

Mo., Joplin—Bd. of Education, S. A. Harris, Secy., will receive bids until Mar. 31 for the construction of a 2 story junior high school including manual training department, machine shop, etc. Estimated cost $250,000. T. W. Williamson & Co., Farmers National Bank Bldg., Topeka, Kan., Archts. B. F. Cook, 713 Linwood Blvd., Kansas City, Engr.

N. J., Montclair—G. H. Nash, 44 Walnut Crescent, awarded contract for the construction of a 1 story, 85 x 125 ft. factory at 103-07 Grove St. Estimated cost $40,000.

N. J., Newark—A. Gross & Co., Doremus Ave., awarded contract for a 1 story, 85 x 100 ft. candle manufacturing plant. Estimated cost $40,000.

N. J., Newark—W. Snyder, 790 Broad St., Archt., is receiving bids for the construction of a 3 story, 50 x 100 ft. woodworking plant on New York Ave. for J. C. Kohaut Inc., 117 Green St. Estimated cost $40,000. Noted Dec. 4.

N. J., Newark—New Jersey Bell Telephone Co., 540 Broad St., will receive bids about May 1 for the construction of a gas warehouse, etc., at Fabian Pl. and Foretta Ave. Estimated cost $250,000. Voorhees, Gmelin & Walker, 101 Park Ave., New York, Archts.

N. Y., Brooklyn—Dept. of Hospitals, Municipal Bldg., New York, will receive bids about Apr. 15 for the construction of a garage, etc., at Coney Island Hospital here. G. M. McCabe, 96 5th Ave., New York, Archt.

N. Y., Endicott—International Business Machines Corp., 270 Broadway, New York, plans a 4 story, 50x56 ft. addition to manufacturing plant. Estimated cost to exceed $100,000. C. Higgins, 101 Park Ave., New York, Archt.

N. Y., Jamaica—Wohlbro Improvement Co., 149-27 Jamaica Ave., plans the construction of a 100x104 ft. service garage, auto laundry, etc., at Merrick Blvd. and 116th Ave. Estimated cost $40,000. A. McLean, 149-27 Jamaica Ave., Archt.

N. Y., New York—R. Gangi, 3978 Paulding Ave., will soon receive for the construction of a 3 story service garage at 225th St. and Paulding Ave. Estimated cost to exceed $50,000. F. J. Ross, 4200 White Plains Ave., Archt. Noted Mar. 5.

O., Cleveland—United Improvement Co., Swetland Bldg., awarded contract for a 1 story, 60x 105 ft. factory and office at 4103 Carnegie Ave. Estimated cost $40,000.

O., Cleveland—Warner M. Bateman, 5403 Prospect Ave. (Reo distributor) plans the construction of a 2 story, 113x130 ft. automobile sales and service station on East 83rd St. and Carnegie Ave. Estimated cost $150,000. Architect not selected.

O., Youngstown—Youngstown Sheet & Tube Co., J. A. Campbell, Chn., Stambaugh Bldg., plans the construction of a new continuous sheet mill. Estimated cost $1,000,000.

Okla., Oklahoma City—H. M. Johnson, c/o First National Bank, is having preliminary plans prepared for the construction of a 14 story garage building on First St. Estimated cost $800,000. Architect not announced.

Pa., Erie—Bd. of Education, R. S. Scovell, Secy., Library Bldg., will receive bids until Apr. 16 for the construction of a 1 story, 40 x 270 ft. technical high school at 10th and Sassafrass Sts. Meyers & Johnson, 821 Commerce Bldg., Archts.

Pa., Oil City—Oil City Boiler Works, plans addition to manufacturing plant. Estimated cost $50,000.

Pa., Pittsburgh—Allegheny County Commissioners are having revised plans prepared for the construction of an administration building, hangars and garage building. Estimated cost $252,000. S. L. Rousch, 519 Smithfield St., is architect.

Pa., Pittsburgh—D. J. Rex Box Co., Boyd and Locust Sts., is having plans prepared for the construction of a paper bag factory. Estimated cost $40,000. Private plans.

Tex., Fort San Houston—(sta. San Antonio)—H. B. Nurse, Constructing Quartermaster, is having plans prepared for the construction of depot shop buildings at Dunean Field. Estimated cost $500,000.

Tex., San Antonio—Hydro-Plant Corp., D. J. Little, Pres., c/o L. E. Rush, Western Life Insurance Bldg., acquired a site and plans the construction of a plant for the manufacture of hydraulic auto brakes and other hydraulic machinery, also hydraulic pumps, to include engineering department, automotive department, machine and tool department, etc. Estimated cost $500,000.

Va., Hampton Roads—Bureau of Yards & Docks, Navy Dept., Washington, D. C., received lowest bid for the construction of a 160 x 203 ft. addition to hangar and shop building here, from R. R. Richardson, Norfolk. $82,697. Noted Feb. 19.

Wash., Seattle—Clinton Construction of California, Gen. Contrs., awarded contract for reinforcing steel for a new plant for Ford Motor Co. here. $3,000,000. Noted Feb. 5.

Wis., Milwaukee—Bd. of School Directors, will soon award contract for the construction of a woodworking shop at West Division High School. G. E. Wiley, c/o School Board, Archt.

B. C., Vancouver—Western Bridge Co., Ltd., First Ave. and Columbia St., is having plans prepared for reconstruction of existing structural steel and bridge fabricating plant at False Creek. Estimated cost $500,000. Private plans.

Int., Hamilton—Anchor Cap & Closure Corp., I. R. Stewart, Pres., 22 Queens Ave., Long Island City, N. Y., acquired a site and plans the construction of a plant here.

Ont., Kingston—Bd. of Education, plans the construction of a 3 story vocational and technical school. Estimated cost $350,000. C. Drever, 81 Brock St., Archt.

On., Sudbury—International Nickel Co., 67 Wall St., New York, N. Y., awarded contract for the construction of a hoist house and steel head frame. Estimated cost to exceed $40,000.

Que., Montreal—S. T. Johnson Co., C. Henry Stanyon, V. Pres., ft. of Livingston St., Oakland, Calif., plans the construction of a plant for the manufacture of oil burners here.

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The Agent—
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